Biological Assessment on Continued Operation and Maintenance of the Rogue River Basin Project and Effects on Essential Fish Habitat under the Magnuson-Stevens Act

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region

Lower Columbia Area Office
Portland, Oregon

Pacific Northwest Regional Office
Boise, Idaho

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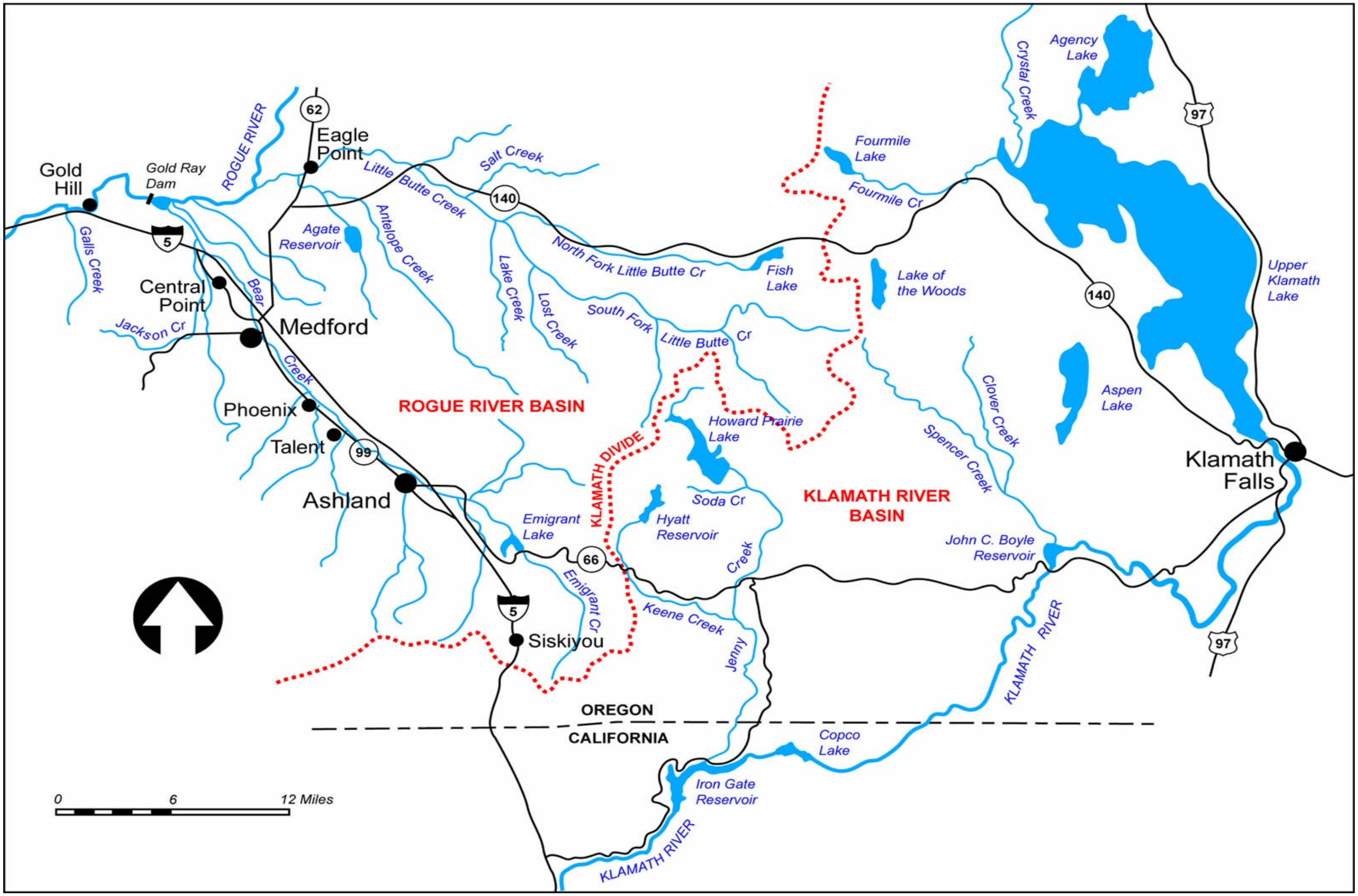
U.S. Department of the Interior

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities.

Mission of the Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.



Frontispiece: General Location Map of Rogue River Basin and Klamath River Basin

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Selected Abbreviations and Acronyms List

BA	biological assessment
BECA	Bald Eagle Consideration Area
BEMA	Bald Eagle Management Area
BLM	Bureau of Land Management
BO	biological opinion
CDFG	California Department of Fish and Game
cfs	cubic feet per second
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
GWEB	Governor's Watershed Enhancement Board
IPOD	Irrigation point of diversion
KPOPSIM	Klamath Project Operations Simulation Model
kW	kilowatt
MID	Medford Irrigation District
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity units
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OFWC	Oregon Fish and Wildlife Commission

O&M	operation and maintenance
ONHP	Oregon Natural Heritage Program
ONHIC	Oregon Natural Heritage Information Center
OWRD	Oregon Water Resources Department
Reclamation	Bureau of Reclamation
RM	river mile
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measures
RBFAT	Rogue Basin Fish Access Team
RRVID	Rogue River Valley Irrigation District
RV	recreational vehicle
RVCOG	Rogue Valley Council of Governments
RZ	Bald Eagle Recovery Zone
SONCC	southern Oregon/northern California coasts coho salmon
SWOSRI	Southwest Oregon Salmon Restoration Initiative
TAF	thousand acre-feet
TID	Talent Irrigation District
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
WCFS	Reclamation's Water Conservation Field Services Program
WCP	Wetland Conservation Plan
WQMP	Water Quality Management Plan

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Chapter 1.0 Introduction

1.1 Introduction

The Bureau of Reclamation (Reclamation) is submitting this Biological Assessment (BA) pursuant to Section 7(a) (2) of the Endangered Species Act (ESA) to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). This BA describes and analyzes the effects of the operation and maintenance (O&M) of the Rogue River Basin Project, Talent Division (Project) on critical habitat and listed species. In addition, this document includes the effects on essential fish habitat (EFH) as required under the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996.

The Project is located in southwest Oregon near the city of Medford and encompasses Little Butte Creek, Bear Creek, Antelope Creek, and Dry Creek in the Rogue River basin and tributaries of Jenny Creek in the Klamath River basin (*Frontispiece*). The Project covers approximately 35,000 acres of irrigated cropland in three irrigation districts: Talent Irrigation District (TID), Medford Irrigation District (MID), and Rogue River Valley Irrigation District (RRVID) (Figure 1-1).

Congress, by the Act of August 20, 1954 (68 Stat. 752, Public Law 83-606), authorized the Secretary of the Interior to construct the Rogue River Basin Project Talent Division, consisting of "two principal reservoirs at the Howard Prairie and Emigrant sites, together with other necessary works for the collection, impounding, diversion, and delivery of water, the generation and transmission of hydroelectric power and operations incidental thereto."

Talent Division was authorized for the purposes of irrigation, flood control, hydroelectric power, and for other beneficial purposes. Fish and wildlife facilities and minimum basic recreation facilities were also authorized. The Secretary of the Interior was also authorized to undertake the rehabilitation of some existing facilities in MID and RRVID under the provisions of the Rehabilitation and Betterment Act of October 7, 1949 (63 Stat. 724, Public Law 81-335), as amended.

The 1954 Act was amended by the Act of October 1, 1962 (76 Stat 677, Public Law 87-727) to authorize construction of Agate Dam and Reservoir, a diversion dam, feeder canals, and related facilities as a part of the Talent Division. Minimum basic recreation facilities and facilities for the conservation and development of fish and wildlife were also authorized.

Each federal agency has an obligation to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or destroy or adversely modify its critical habitat unless that activity is exempt pursuant to the ESA (16 U.S.C§ 1536(a) (2); 50 CFR § 402.03). Under relevant regulations, 50 CFR § 402.12(f), the "contents of a biological assessment are at the discretion of the Federal agency and will depend on the nature of the Federal action." Reclamation followed 50 CFR § 402.12(f) and the *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act* (USFWS and NMFS 1998) in developing the content of this BA.

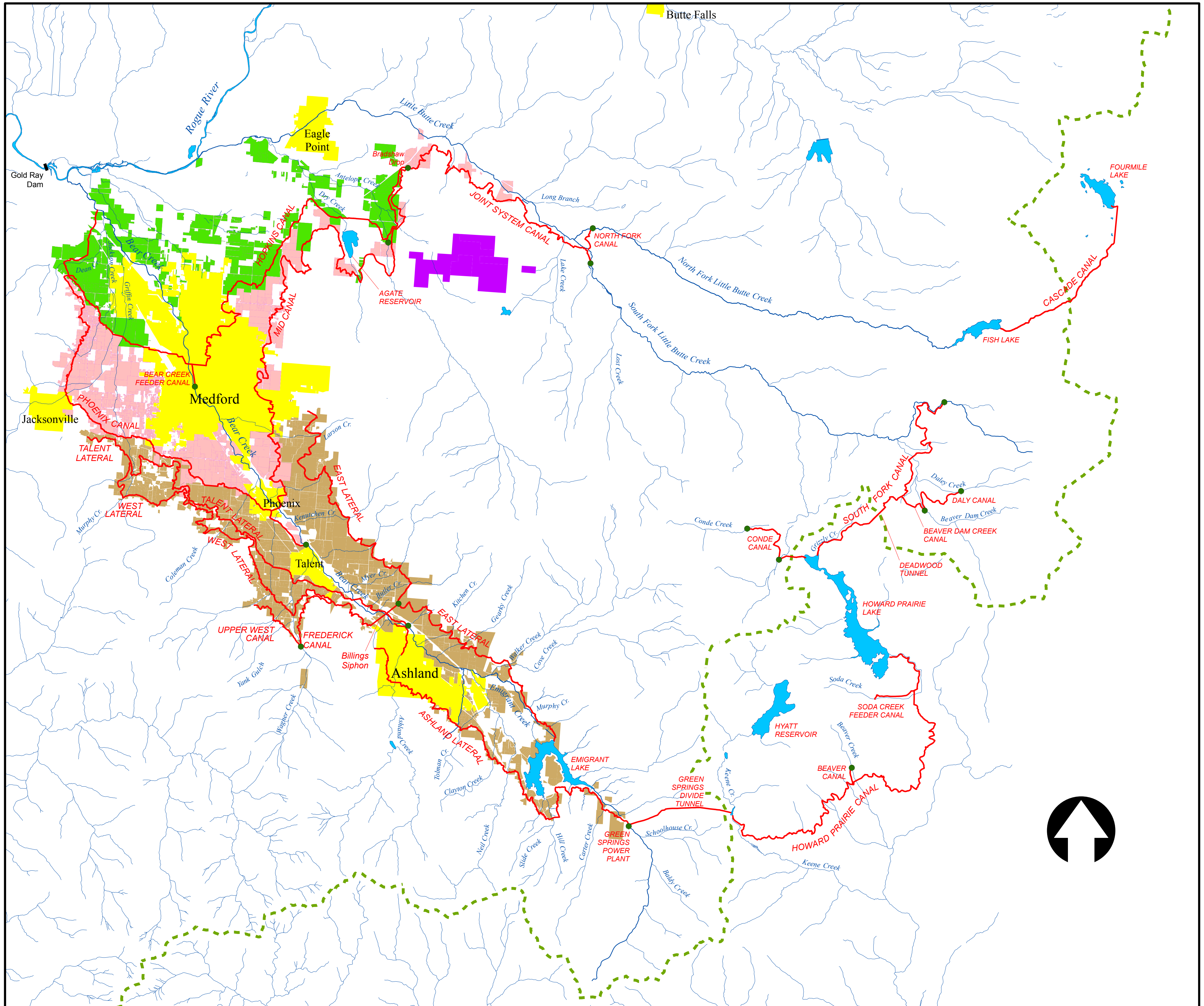
1.2 Reclamation's Approach to the Consultation Process

- General Approach

  This BA assesses the effects of the operation and maintenance actions as currently proposed, and will be in effect until or unless reinitiation of consultation is required. In this approach, Reclamation has analyzed, and is consulting on Federal activities. However, not all activities are discretionary, and Reclamation does not control all Project operations. Any potential operational changes require research on the part of our contracting and legal staff.

- Non-Federal Actions

  Reclamation should not be responsible for the effects of all water development and land management activities, both Federal and non-Federal, on endangered species throughout the Rogue River basin. For example, Reclamation cannot be responsible for streamside rural development, road building, forest management, or grazing influences on endangered species. Non-Federal actions are included in the ESA defined environmental baseline.



Rogue River Basin Project, Oregon
Talent Division

Irrigation Districts

0 1 2 3 4 5 Miles

Source: Talent Irrigation District 04/18/02

LEGEND

- Canals
- Cities
- Reservoirs and Lakes
- Major Streams
- Ancillary Streams
- Rogue River Valley Irrigation District (RRVID)
- Talent Irrigation District
- Medford Irrigation District (MID)
- Joint MID-RRVID
- Diversions
- Cascade Divide

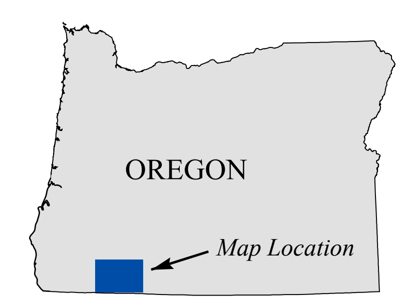


Figure 1-1

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- Involvement of Contracting Districts, Tribes, and Other Parties

  Although non-Federal actions are not included in the proposed action, contracting irrigation districts, tribes and other parties are involved in discussion on Project operations affecting the Rogue River basin. This is consistent with the Secretary of the Interior's "four Cs" policy, which commits all Interior agencies to communication, consultation, cooperation, and conservation when undertaking Departmental efforts.

- Tribal Water Rights and Trust Resources

  Oregon now has nine federally recognized tribes: Burns Paiute Tribe, Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz, Confederated Tribes of Warm Springs, Confederated Tribes of Umatilla Indian Reservation, Cow Creek Band of Umpqua Indians, Klamath Tribes, and Coquille Tribe. None of these tribes are located in the Rogue River basin.

  There are four federally recognized Indian Tribes in the Klamath River basin. These tribes are the Klamath Tribes in Oregon, and the Yurok, Hoopa, and Karuk Tribes in California. The Klamath Tribes' water rights are currently included in the pending Klamath Basin adjudication in Oregon. There are currently no proceedings pending to determine the other tribes' water rights.

1.3 Key Things You Should Know When Reading This BA

- Federal and Non-Federal Facilities

  As used in this document, the term Project encompasses both Federal and non-Federal facilities. Federal facilities are those facilities acquired or constructed pursuant to the authority of the Reclamation Act of 1902, and all acts amendatory thereof and supplementary thereto. Non-Federal facilities are those facilities held under private ownership and not covered under Reclamation law.

- Transferred/Reserved Works

  Reclamation's ability to design, construct, operate and maintain project facilities is dependent upon Congressional authorization. Congress also authorizes Reclamation to conduct these activities and operate and maintain them for a period of time. After that time, Reclamation enters into an agreement with the beneficial user, e.g., an irrigation district, transferring the operation and maintenance responsibilities to that user. These facilities are referred to as transferred works. However, these agreements do not transfer ownership of the facilities. Only Congress can authorize transfer of title of facilities out of Federal ownership.

  Occasionally, O&M responsibilities to certain facilities are not transferred to the beneficial user for specific reasons. These facilities are referred to as reserved works and are staffed, operated and maintained by Reclamation. The only reserved works in the Project is the Green Springs Powerplant and its appurtenant facilities (Cascade Tunnel inlet, Cascade Tunnel, penstock/wasteway control valves, penstock, etc.)

- Transbasin Water Supplies

  The first system consists of collection and conveyance facilities that transfer water from the headwaters of the South Fork of Little Butte Creek to Howard Prairie Lake and Hyattt Reservoir storage facilities in the Klamath basin. This water then returns to the Rogue River basin via the Howard Prairie Delivery Canal. The second transbasin water system consists of collection, storage, and conveyance facilities that transfer unregulated flows from tributaries of Jenny Creek in the Klamath River basin to Rogue River basin streams. Operational effects of the water transfer on ESA species in Klamath River basin have been excluded from Klamath Project ESA consultations and will be evaluated in this BA.

- Contracts

  Reclamation has repayment contracts with TID, MID, and RRVID for the Project. These contracts provided for the past rehabilitation, enlargement, and extension of existing facilities, the construction of new facilities, operation and maintenance, and the repayment of costs associated with the work. All Project construction and rehabilitation work has been completed.

- Qualitative versus Quantitative Approaches

  This BA includes a portion of the Rogue River basin and a portion of the Klamath River basin. More quantitative data is available for the Klamath River basin, thus the effects analysis uses a quantitative approach. The Rogue River basin lacks quantitative studies. Data collection has been sporadic with few research studies, thus the available information has been presented in a qualitative manner. The best available data and information are used in both cases.

- Environmental Baseline

  The environmental baseline describes a "snapshot in time" which includes the effects of all past and present Federal, state, private and other human activities but not the effects of the proposed action that is the subject of the consultation. Thus, all existing facilities and all previous and current effects of the construction and operation of the Project are part of the ESA-defined environmental baseline. Also included in the environmental baseline are all ongoing, non-Federal irrigation activities, as well as existing physical features such as diversion dams, storage dams, and flood control dikes. The future operation and maintenance of the Federal facilities is the proposed action under consultation, the effects of which are to be assessed and determined in the consultation process.

- Hydrologic Effects Analysis

  Reclamation used the MODSIM model for this BA to provide information to assist in determining the hydrologic effects of the ongoing proposed action. Two scenarios were modeled. One scenario simulates current and ongoing operations including Reclamation's proposed action and is called "with Reclamation" in the remainder of the document. This scenario reflects the proposed action, interrelated and interdependent actions, and other actions such as private irrigation.

  The second scenario simulates hydrologic conditions without the proposed action and is termed "without Reclamation". This scenario removes the operation of Reclamation's facilities. The "with Reclamation" scenario can be compared to the "without Reclamation" scenario to determine the hydrologic effects of the proposed action.

1.4 Previous Consultations

Reclamation has informally consulted with USFWS and NMFS since 1995 under Section 7 of the ESA on several projects and programs undertaken in the Rogue River Basin Project action area. Reclamation evaluated these actions under National Environmental Policy Act (NEPA) environmental compliance requirements using the respective NEPA documents to identify the effects of the action on ESA proposed or listed species. Accordingly, the ESA effects analysis of four separate Reclamation actions have been included in environmental assessment documents followed by Findings of No Significant Impacts (Table 1-1). Reclamation concluded in all four cases no listed species would be affected. NMFS and USFWS subsequently concurred with these findings.

Table 1-1. Previous Reclamation ESA Section 7 Consultations in Rogue River Basin Project Action Area

Project Name (NEPA Document)	Listed Species	Consultation Results	USFWS/NMFS Determination
Emigrant Lake Resource Management Plan, Oregon (FONSI/FEA September 1995)	Bald eagle	No Effect	Concurrence by USFWS, June 1995
Rogue River Basin Fish Passage Improvement Program, Oregon (FONSI/FEA March 1997)	Peregrine falcon, bald eagle, northern spotted owl	No Effect	Concurrence by USFWS, March 1997
J. Herbert Stone Constructed Wetlands Demonstration Project, J. Herbert Stone Nursery, Oregon (FONSI/FEA July 1999)	SONCC coho salmon, peregrine falcon, bald eagle, northern spotted owl	No Effect	Concurrence by USFWS and NMFS, 2000
Agate Reservoir Resource Management Plan, Oregon (FONSI/FEA September 2000)	SONCC coho salmon, vernal pool fairy shrimp, peregrine falcon, bald eagle, northern spotted owl	No Effect	Concurrence by USFWS and NMFS, 2000

1.5 How This Biological Assessment Is Organized

Each chapter in the BA has an introduction that describes the applicable regulation and the content of the chapter. The information on the Rogue River basin is listed first, followed by the information for the Klamath River basin. Species are grouped taxonomically.

- Chapter 1 provides the preliminary information that is helpful in reading the rest of the document.
- Chapter 2 describes the action area and the proposed action. The description of the proposed action summarizes key information contained in the Rogue River Basin Project, Talent Division, Oregon, Facilities and Operations report (Vinsonahler 2002) . This report was sent to the Services and other interested entities in April 2002.
- Chapter 3 lists the status, location, and a summary of the life history of listed species. If a species was determined to be outside the action area, it is not discussed in the remainder of the BA.
- Chapter 4 describes the environmental baseline condition for the listed species. The environmental baseline provides a snapshot in time of the effects of all past and present Federal, state, private, and other human activities in the action area.
- Chapter 5 presents the Little Butte Creek and Bear Creek Surface Water Distribution Model used to analyze the hydrologic effects of the proposed action.
- Chapter 6 describes the effects of the proposed action on listed species and critical habitat.
- Chapter 7 provides information on cumulative effects for each species in the action area. We've provided descriptions of a range of beneficial activites that Local Coordinating Groups have participated in since 1999.
- Chapter 8 provides the essential fish habitat assessment under the Magnuson-Stevens Fishery Conservation and Management Act.
- Chapter 9, the bibliography, is followed by two appendices.

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Chapter 2.0 Description of the Proposed Action

2.1 Introduction

This chapter provides a description of the action area and statement of the proposed action followed by a summary of the proposed action. The Rogue River Basin Project Talent Division, Oregon Facilities and Operations report (Vinsonhaler 2002) provides a comprehensive description of Project operation and hydrologic conditions.

2.2 Description of the Action Area

Reclamation defines the "action area" as all areas to be affected directly or indirectly by the Federal action, in this case, Project O&M activities. Project facilities and features lie within either the Rogue River basin or Klamath River basin.

The action area affected by Project O&M includes reservoirs and stream reaches primarily used by the three Project irrigation districts to divert, store, and deliver water as well as diversion dams, and water conveyance canals.

2.3 Proposed Federal Action

The proposed action is for Reclamation, pursuant to contracts with MID, RRVID, and TID, to continue to divert, store, deliver water, and operate and maintain Federal Project facilities consistent with past operation and maintenance. Summary tables are provided for dams and reservoirs (Table 2-1), diversion dams and conveyance or feeder canals (Table 2-2), and main conveyance canals (Table 2-3).

2.4 Interrelated and Interdependent Actions

Interrelated and interdependent actions are components of the overall determination of effects on ESA listed species or critical habitat effected by the proposed action. Interrelated and interdependent activity definitions as used in this BA are taken from USFWS and NMFS, *Consultation Handbook* (1998). An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Interrelated or interdependent activities are measured against the proposed action.

The Hopkins Canal, Jackson Street Diversion Canal, Phoenix Canal and Jackson Street Diversion Dam and Feeder Canal are privately owned facilities and are considered interrelated and interdependent due to the co-mingling of water delivered under Federal and private water rights. While these facilities could operate without the proposed action, it would be difficult to partition the water for separate effects analyses.

Other private facilities within the Project are not considered interrelated or interdependent because these facilities (1) do not depend on the proposed action for their justification and (2) have independent utility from the proposed action.

2.5 Description of the Proposed Federal Action

The proposed action description contains (1) Upper South Fork Little Butte Creek and Bear Creek areas (includes Jenny Creek) and (2) Antelope Creek and Dry Creek areas. Each section contains a description of the facilities and general operation procedures, broken down by water collection and storage facilities, and conveyance facilities (Figure 2-1). A detailed explanation of the facilities and operation and maintenance is provided in Rogue River Basin Project Talent Division, Oregon Facilities and Operations report (Vinsonhaler 2002).

Table 2-1. Dams and Reservoirs

Facility	BA Status	Facility Ownership	Location	Original Construction or Reclamation Rehabilitation	Storage or Water Right	O&M Responsibility
Agate Dam and Reservoir	Proposed Action	Reclamation	Dry Creek (Rogue)	Reclamation constructed in 1966	RRVID	RRVID
Howard Prairie Dam and Lake	Proposed Action	Reclamation	Jenny Creek (Klamath)	Reclamation constructed in 1958	Reclamation	TID
Hyatt Dam and Reservoir	Proposed Action	Reclamation	Keene Creek (Klamath)	TID built in 1922, Reclamation rehabilitated in 1961	TID	TID
Keene Creek Dam and Reservoir	Proposed Action	Reclamation	Keene Creek (Klamath)	Reclamation constructed in 1959	Reclamation & TID	TID
Green Springs Powerplant	Proposed Action	Reclamation	Emigrant Creek (Rogue)	Reclamation constructed in 1960	Reclamation & TID	Reclamation
Emigrant Dam and Lake	Proposed Action	Reclamation	Emigrant Creek (Rogue)	TID built in 1924, Reclamation rebuilt in 1961	Reclamation & TID	TID

Table 2-2. Diversion Dams and Collection or Feeder Canals

Facility	BA Status	Facility Ownership	Location	Original Construction or Reclamation Rehabilitation	Water Right	O&M Responsibility
Upper South Fork Little Butte Creek Diversion Dam and Collection Canal	Proposed Action	Reclamation	South Fork Little Butte Creek (Rogue)	Reclamation constructed in 1960	Reclamation	TID
Pole Bridge Creek Diversion Dam	Proposed Action	Reclamation	Pole Bridge Creek (Rogue)	Reclamation constructed in 1960	TID assigned to Reclamation	TID
Daley Creek Diversion Dam and Collection Canal	Proposed Action	Reclamation	Daley Creek (Rogue)	Reclamation constructed in 1960	TID assigned to Reclamation	TID
Beaver Dam Creek Diversion Dam	Proposed Action	Reclamation	Beaver Dam Creek (Rogue)	Reclamation constructed in 1960	TID assigned to Reclamation	TID
Conde Creek Diversion Dam and Collection Canal	Proposed Action	Reclamation	Conde Creek (Rogue)	Reclamation constructed in 1958	TID assigned to Reclamation	TID

Facility	BA Status	Facility Ownership	Location	Original Construction or Reclamation Rehabilitation	Water Right	O&M Responsibility
Dead Indian Creek Diversion Dam	Proposed Action	Reclamation	Dead Indian Creek (Rogue)	Reclamation constructed in 1958	TID assigned to Reclamation	TID
Soda Creek Diversion Dam and Feeder Canal	Proposed Action	Reclamation	Soda Creek (Klamath)	Reclamation constructed in 1959	TID	TID
Little Beaver Creek Diversion Dam and Delivery Canal	Proposed Action	Reclamation	Little Beaver Creek (Klamath)	Reclamation constructed in 1959	TID	TID
Antelope Creek Diversion Dam and Feeder Canal	Proposed Action	Reclamation	Antelope Creek (Rogue)	Reclamation constructed in 1966, fish screen & passage added in 1998	RRVID	RRVID
Agate Reservoir Feeder Canal	Proposed Action	Reclamation	Dry Creek (Rogue)	Reclamation constructed in 1966	RRVID	RRVID
Ashland Canal Diversion Dam	Proposed Action	Reclamation	Emigrant Creek (Rogue)	Reclamation relocated original works and rebuilt in 1959	TID and Reclamation	TID
Oak Street Diversion Dam	Proposed Action	Reclamation	Bear Creek (Rogue)	Reclamation constructed in 1961, fish screen & passage added in 1997	TID and Reclamation	TID

Facility	BA Status	Facility Ownership	Location	Original Construction or Reclamation Rehabilitation	Water Right	O&M Responsibility
Phoenix Canal Diversion Dam and Feeder Canal	Proposed Action	Reclamation	Bear Creek (Rogue)	originally built about 1900, Reclamation rehabilitated in 1960, fish screens & passage added in 1998	MID	MID
Jackson Street Diversion Dam and Feeder Canal	Interrelated and Interdependent	RRVID	Bear Creek (Rogue)	originally built about 1910, removed and replaced in an upstream location in 1998, fishscreen & passage added in 1999	RRVID	RRVID

Table 2-3. Main Conveyance Canals

Facility	BA Status	Facility Ownership	Location	Original Construction or Reclamation Rehabilitation	O&M Responsibility
Deadwood Tunnel	Proposed Action	Reclamation	South Fork Little Butte Creek (Rogue)	Reclamation constructed 1956-1958	TID
Howard Prairie Delivery Canal	Proposed Action	Reclamation	Jenny Creek watershed (Klamath)	Reclamation constructed 1956-1959	TID
Cascade Divide Tunnel	Proposed Action	Reclamation	(Cascade Divide)	Reclamation constructed 1958-1959	TID
Green Springs Tunnel	Proposed Action	Reclamation	(Rogue)	Reclamation constructed 1957-1959	TID
Ashland Canal	Proposed Action	Reclamation	Emigrant Creek (Rogue)	constructed in 1923	TID
East Canal	Proposed Action	Reclamation	Emigrant Creek (Rogue)	constructed in 1925	TID
West Canal	Proposed Action	Reclamation	Bear Creek (Rogue)	constructed in 1925	TID
Talent Canal	Proposed Action	Reclamation	Bear Creek (Rogue)	constructed prior to 1925	TID
Phoenix Canal	Interrelated & Interdependent	MID	Bear Creek (Rogue)	constructed in 1960	MID
Jackson Street Diversion Canal	Interrelated & Interdependent	RRVID	Bear Creek (Rogue)	constructed in 1906	RRVID
Hopkins Canal	Interrelated & Interdependent	RRVID	(Rogue)	constructed prior to 1910	RRVID

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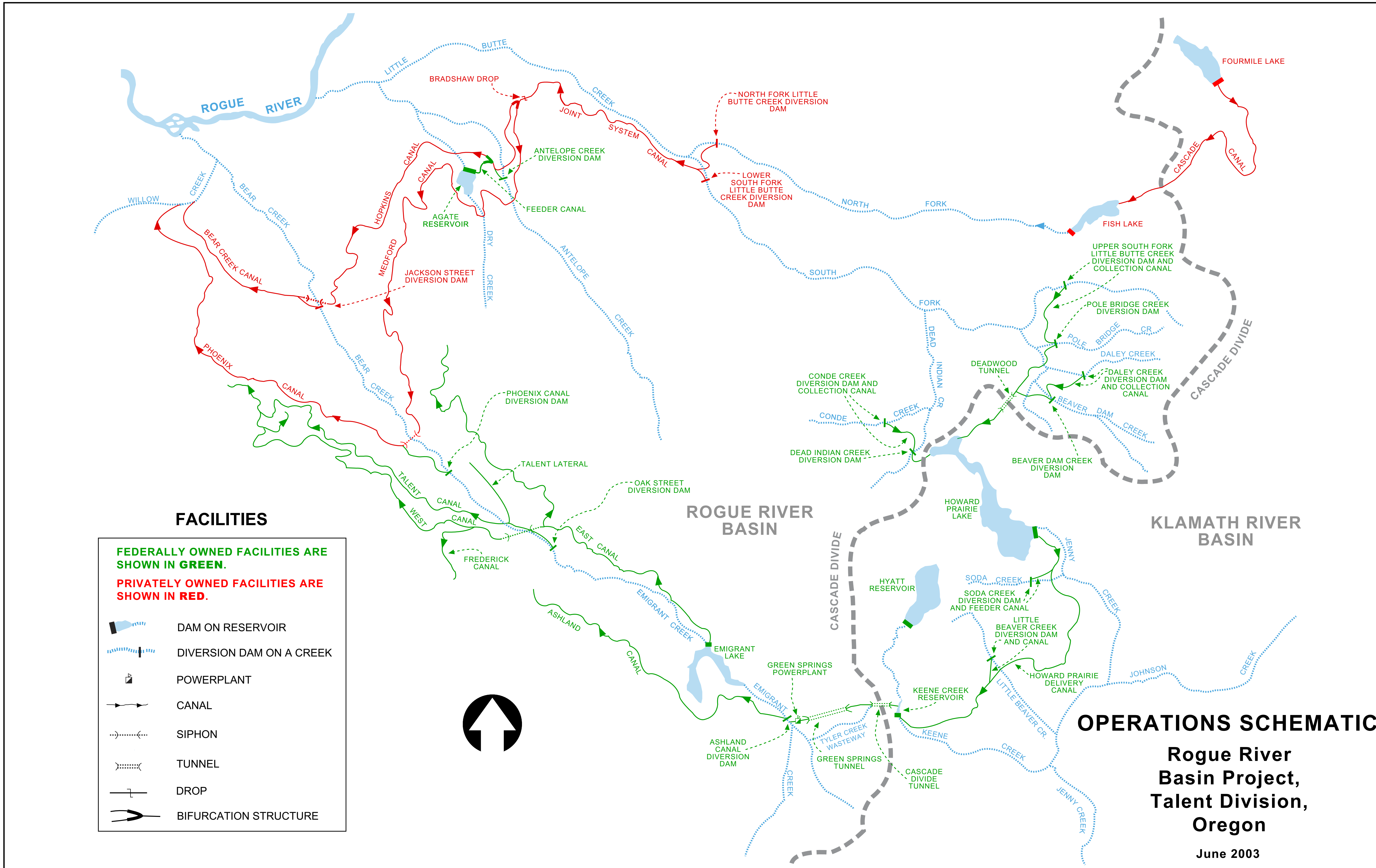
OPERATIONS SCHEMATIC
Rogue River Basin Project, Talent Division, Oregon
June 2003
FACILITIES
FEDERALLY OWNED FACILITIES ARE SHOWN IN GREEN.
PRIVATELY OWNED FACILITIES ARE SHOWN IN RED.
DAM ON RESERVOIR
DIVERSION DAM ON A CREEK
POWERPLANT
CANAL
SIPHON
TUNNEL
DROP
BIFURCATION STRUCTURE
ROGUE RIVER BASIN
KLAMATH RIVER BASIN
CASCADE DIVIDE
CASCADE DIVIDE
ROGUE RIVER
LITTLE BUTTE CREEK
NORTH FORK
SOUTH FORK
WILLOW CREEK
BEAR CREEK
DRY CREEK
ANTELOPE CREEK
BRADSHAW DROP
JOINT SYSTEM CANAL
NORTH FORK LITTLE BUTTE CREEK DIVERSION DAM
LOWER SOUTH FORK LITTLE BUTTE CREEK DIVERSION DAM
FOURMILE LAKE
CASCADE CANAL
FISH LAKE
ANTELOPE CREEK DIVERSION DAM
FEEDER CANAL
AGATE RESERVOIR
HOPKINS CANAL
MEDFORD CANAL
JACKSON STREET DIVERSION DAM
BEAR CREEK CANAL
PHOENIX CANAL
PHOENIX CANAL DIVERSION DAM
TALENT LATERAL
TALENT CANAL
WEST CANAL
EAST CANAL
OAK STREET DIVERSION DAM
FREDERICK CANAL
ASHLAND CANAL
EMIGRANT CREEK
EMIGRANT LAKE
ASHLAND CANAL DIVERSION DAM
GREEN SPRINGS POWERPLANT
TYLER CREEK WASTEWAY
GREEN SPRINGS TUNNEL
CASCADE DIVIDE TUNNEL
KEENE CREEK RESERVOIR
KEENE CREEK
HYATT RESERVOIR
HOWARD PRAIRIE LAKE
HOWARD PRAIRIE DELIVERY CANAL
LITTLE BEAVER CREEK DIVERSION DAM AND CANAL
LITTLE BEAVER CR.
SODA CREEK
SODA CREEK DIVERSION DAM AND FEEDER CANAL
JENNY CREEK
JOHNSON CREEK
UPPER SOUTH FORK LITTLE BUTTE CREEK DIVERSION DAM AND COLLECTION CANAL
POLE BRIDGE CREEK DIVERSION DAM
POLE BRIDGE CR.
DALEY CREEK
DALEY CREEK DIVERSION DAM AND COLLECTION CANAL
DEADWOOD TUNNEL
BEAVER DAM CREEK
BEAVER DAM CREEK DIVERSION DAM
CONDE CREEK
CONDE CREEK DIVERSION DAM AND COLLECTION CANAL
DEAD INDIAN CR.
DEAD INDIAN CREEK DIVERSION DAM

Figure 2-1

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2.5.1 Upper South Fork Little Butte Creek Area and Bear Creek Area

The Upper South Fork Little Butte Creek Area and Bear Creek Area include the following facilities:

Water Collection and Storage Facilities

- Water collection facilities on the headwaters of South Fork Little Butte Creek and its tributaries in the Rogue River basin which collect and move water from the Rogue River basin for storage in Klamath River basin.
- Water collection facilities on Jenny Creek tributaries in Klamath River basin
- Water storage facilities on Jenny Creek tributaries in Klamath River basin.
- Water storage facilities on Emigrant Creek in Rogue River basin.

Water Conveyance Facilities

- Water conveyance facilities which move water from the Rogue River basin to the Klamath River basin.
- Water conveyance facilities which move water from the Klamath River basin to the Rogue River basin.
- Diversion dams on Bear Creek which divert water into canals.

Powerplant Facilities

- Green Springs Powerplant

Water Collection and Storage Facilities

Vinsonhaler 2002, pages 3-5 through 3-7 shows collection and storage facilities of the Project, including private components.

Water Collection Facilities

A portion of the South Fork Little Butte Creek streamflows in Rogue River basin are diverted near its headwaters by the upper South Fork Diversion Dam into South Fork Collection Canal. From here, the canal extends about 4 miles where flows from Pole Bridge Creek are intercepted. At about mile 7.4, South Fork Collection Canal is joined by Daley Creek Collection Canal which collects runoff from Daley Creek and

Beaver Dam Creek. At mile 8.6, the 130 cfs capacity South Fork Collection Canal enters Deadwood Tunnel which conveys the collected runoff from the west to east side of Cascade Divide. This water is then discharged into the natural channel of Grizzly Creek and flows into Howard Prairie Reservoir in Klamath River basin.

Water from two other headwater tributaries of South Fork Little Butte Creek is also moved from Rogue River basin to Klamath River basin. The flow of Conde Creek is diverted at Conde Creek Diversion Dam into the Conde Creek Canal which terminates at Dead Indian Creek. The combined flow is then diverted into the 86 cfs capacity Dead Indian Creek Canal which crosses Cascade Divide and discharges into Howard Prairie Reservoir in the Klamath River basin.

These water collection facilities are operated and maintained by TID. The facilities can operate year round but most creek diversions usually occur during winter and spring months prior to the needs of downstream senior natural flow rights in Little Butte Creek drainage.

The average amount of water transferred for water years 1962 to 1999 was about 15,500 acre-feet (Table 2-4). Table 2-4 provides an estimate of the volume and timing of average monthly diversions of South Fork Little Butte Creek transbasin transfers.

Table 2-4. Average Monthly South Fork Little Butte Creek[1] Transbasin Water Transfer, Rogue River Basin Project (acre-feet)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
259	618	1,510	1,603	1,636	2,285	3,020	3,127	1,059	277	54	49

[1] Average of the sum of measured flow for water years 1962 to 1999. South Fork Little Butte Creek Collection Canal near Pinehurst (USGS:1433940) and Dead Indian Canal near Pinehurst (USGS:14340400).

Water Storage Facilities

The storage facilities in the South Fork Little Butte Creek Area and Bear Creek Area include: Howard Prairie Dam and Reservoir (Lake), Hyatt Dam and Reservoir, and Keene Creek Dam and Reservoir on Jenny Creek drainage in Klamath River basin, Emigrant Dam and Reservoir (Lake) on Bear Creek drainage in Rogue River basin. Contracts between Reclamation and TID, MID, and RRVID provide for these reservoirs to be operated as a pooled system with a total active capacity of 115,000 acre-feet. These contracts allocate the pooled storage as follows:

- 8,500 acre-feet (7.3913 percent) is preferred capacity assigned to TID. The first annual inflow to the system is assigned to this preferred capacity.
- The residual capacity of 106,500 acre-feet (92.6987 percent) is considered as new capacity and is assigned as follows:
  - 4,000 acre-feet (3.7559 percent) to RRVID
  - 8,000 acre-feet (7.5117 percent) to MID
  - 94,500 acre-feet (81.3411 percent) to TID

Each irrigation district has the right to carry its stored water over from one year to the next year as long as the stored water does not exceed its assigned reservoir space. TID operates and maintains the water storage facilities.

Howard Prairie Dam and Lake

Howard Prairie Dam and Lake (total capacity 62,100 acre-feet; active capacity 60,600 acre-feet), located on Jenny Creek in Klamath River basin, receives water from South Fork Little Butte Creek transbasin transfers and also captures natural runoff from Jenny Creek watershed. The filling of Howard Prairie Lake can occur at any time and at any rate. There is not any formalized flood control operation for the lake. The priority for filling Howard Prairie Lake is to use runoff from Jenny Creek watershed and supplement it by the transbasin transfers from South Fork Little Butte Creek Collection System.

Howard Prairie Dam and Lake provide water for irrigation purposes in the Bear Creek drainage of Rogue River basin and for hydroelectric generation at Green Springs Powerplant. Releases from Howard Prairie can be made at any time into the 18.7-mile-long Howard Prairie Delivery Canal which terminates at Keene Creek Reservoir. Storage releases are usually maintained at the maximum 53 to 55 cfs carrying capacity of Howard Prairie Delivery Canal throughout the year except as modified by downstream runoff intercepted by the canal enroute to Keene Creek Reservoir. Enroute flows from Soda and Little Beaver Creeks are diverted into Howard Prairie Delivery Canal.

Hyatt Dam and Reservoir

Hyatt Dam and Reservoir (total capacity 16,200 acre-feet; active capacity 16,200 acre-feet) located in Klamath River basin stores runoff from Keene Creek watershed, a tributary of Jenny Creek. Hyatt Reservoir is operated by TID to supplement irrigation and hydroelectric generation water demands not met from Howard Prairie Lake. Hyatt Reservoir releases flow down Keene Creek a few miles to Keene Creek Reservoir.

Hyatt Reservoir can be filled at any time and at any rate. Although no formalized flood control operations exist, prudent efforts are made to maintain some flood control capability. The goal at Hyatt Reservoir is to operate in the top half (8,000 acre-feet) of the reservoir. This allows 8,000 acre-feet of stored water to be carried over to the next year and provides some reasonable assurance Hyatt Reservoir will refill.

Keene Creek Dam and Reservoir

Keene Creek Dam and Reservoir (total capacity 370 acre-feet; active capacity 260 acre-feet) receives water from Howard Prairie Lake by means of Howard Prairie Delivery Canal and from Hyatt Reservoir which is released into Keene Creek. The dam creates an impoundment to regulate flows to Green Springs Powerplant for various generating modes.

Emigrant Dam and Reservoir (Lake)

Emigrant Dam and Lake (total capacity 40,500 acre-feet; active capacity 39,000 acre-feet) sits on Emigrant Creek in Rogue River basin. Emigrant Lake is the lowermost storage facility in this system and gets its water supply from several sources:

- Water transferred by South Fork Little Butte Creek Collection System from Rogue River basin to Klamath River basin and then released from Howard Prairie Lake
- Runoff from Keene Creek (Jenny Creek tributary in Klamath River basin) impounded in and then released from Hyatt Reservoir
- Runoff from various Jenny Creek tributaries in Klamath River basin which is intercepted by Howard Prairie Delivery Canal enroute to Keene Creek Reservoir
- Emigrant Creek natural inflow

Emigrant Dam and Reservoir are operated by TID to provide irrigation water supply in Bear Creek drainage and for flood control. Releases are made into Emigrant Creek or directly into TID's East Canal.

Water can be impounded in the flood control reserved space only when inflow from Emigrant Creek is greater than 600 cfs or flow in Bear Creek at Medford Gage (USGS: 14357500) is forecasted to be greater than 3,000 cfs. Any flood control reserved space filled under the foregoing conditions must be evacuated as soon as possible.

The lake reaches its highest level after April 1. It is drawn down during the irrigation season and reaches its lowest level in mid-October. The outlet gates at Emigrant Dam are normally completely shut at the end of the irrigation season to accomodate refill of the lake. At the end of the irrigation season releases from Emigrant Lake are made only if required by the flood control management plan. Tributaries, and for a time irrigation return flows, provide most of the flow in the mainstem unless flood control releases are made. No ramping protocols are required during changes in releases from Emigrant Lake for flood control purposes.

Project irrigation demands can often be met during the spring months with natural flow from tributaries downstream from Emigrant Dam and irrigation surface and subsurface return flows. When irrigation demands can no longer be fully met from these sources, storage water is released from Emigrant Lake to meet demands of the three irrigation districts. Stored water is called for by MID and RRVID from TID, who operate Emigrant Dam and Reservoir. The released stored water is assessed against the respective irrigation district's stored water supply.

Emigrant Creek flows about 4.5 miles downstream from Emigrant Dam to the confluence of Neil Creek (RM 24.8) where Bear Creek begins. From this point Bear Creek continues an additional 24.8 miles to its confluence with the Rogue River.

Water Conveyance Facilities

The water conveyance facilities which move water from Klamath River basin through the Cascade Divide to Rogue River basin consist of Howard Prairie Delivery Canal, Keene Creek Reservoir, and Green Springs Powerplant and appurtenant works.[1] These facilities transfer water (1) which had been collected from the headwaters of South Fork Little Butte drainage and moved from the west to east side of Cascade Divide for storage in Howard Prairie Lake and (2) Jenny Creek tributary runoff

[1] The Green Springs Powerplant complex consists of the power conduit (the power conduit includes a 2,150-foot-long Cascade Divide Tunnel, a 4,500-foot-long concrete pressure pipe, and a 5,050-foot-long Green Springs Tunnel) and a 9,000-foot-long penstock

impounded by Howard Prairie and Hyatt Dams as well as downstream runoff intercepted en route to Rogue River basin.

Howard Prairie Delivery Canal

The 18.7-mile Howard Prairie Delivery Canal extends from the outlet of Howard Prairie Dam to Keene Creek Reservoir on Keene Creek This canal is operated by TID up to its maximum carrying capacity (53 to 55 cfs) to meet irrigation needs for stored water in Emigrant Lake and to facilitate hydroelectric generation at Green Springs Powerplant.

The extent of releases from Howard Prairie Lake depends upon flows of Soda Creek and Little Beaver Creek which are intercepted en route by Howard Prairie Delivery Canal. Soda and Little Beaver Creek flows and Howard Prairie Lake storage are monitored through the hydromet system. When Howard Prairie Delivery Canal is close to capacity due to Soda Creek and Little Beaver Creek inflows, releases from Howard Prairie Lake are curtailed. Peak inflow from Soda Creek is about 11 cfs and from Little Beaver Creek about 24 cfs.

During water years 1961 to 2000, an annual average amount of about 24,000 acre-feet of runoff from the Jenny Creek drainage was moved from the east to west side of the Cascade Divide through Green Springs Powerplant and appurtenant works. Table 2-5 provides an estimate of the volume and timing of average monthly diversions of this Jenny Creek contribution.

Table 2-5. Average Monthly Jenny Creek[1] Transbasin Water Transfer Rogue River Basin Project (acre-feet)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
238	330	1,014	1,598	3,579	6,171	6,988	2,629	724	358	227	220

[1] Based on observed and estimated flow and reservoir content for water years 1961-2000 at Howard Prairie Lake, Hyatt Reservoir, Green Springs Powerplant, (USGS:14339499, South Fork Little Butte Creek Collection Canal Near Pinehurst), and Dead Indian Collection Canal near Pinehurst (USGS:14340400). See the Draft Technical Memorandum, Jenny Creek Contributions to the Rogue basin, March 1, 2001, in appendix B, Vinsonhaler 2002.

Green Springs Powerplant and Appurtenant Works

Water released from Keene Creek Reservoir flows through Green Springs Powerplant and appurtenant works and is discharged into Emigrant Creek upstream of Emigrant

Lake. The 18 megawatt powerplant and appurtenant works are operated by Reclamation. Power and energy is provided to Bonneville Power Administration at the switchyard.

Green Springs Powerplant operates daily during the irrigation season. During the nonirrigation season, Green Springs Powerplant normally operates on an abbreviated schedule. If Keene Creek Reservoir receives higher than normal flows, then Green Springs Powerplant is operated accordingly. When water bypasses the powerplant, it travels through a wasteway to Schoolhouse Creek, Tyler Creek, and Emigrant Creek.

When total storage in Howard Prairie Lake is less than 20,000 acre-feet, the operation for higher power generation is modified. This is done by reducing the continuous flow into Keene Creek Reservoir to 30 cfs or the amount of available unregulated runoff, whichever is greater.

The average annual transbasin transfer through Green Springs Powerplant and appurtenant works for water years 1962 to 1999 amounts to 39,500 acre-feet. This is comprised of 15,500 acre-feet moved from Rogue River basin by South Fork Little Butte Creek Collection Canal to Howard Prairie Lake (Table 2-4) plus 24,000 acre-feet of Jenny Creek drainage runoff (Table 2-5).

The major water diversion dams and conveyance facilities which carry water within the Rogue River basin and convey the water to points of use include:

- Ashland Canal Diversion Dam, on Emigrant Creek at RM 33.7 about 100 feet downstream from Green Springs Powerplant discharge, diverts up to 48 cfs into Ashland Canal on the west side of the creek.
- The 132 cfs capacity East Canal receives water directly from Emigrant Dam at RM 29.3 and the 39 cfs capacity West Canal bifurcates off East Canal at mile 11.0.
- Oak Street Diversion Dam at RM 21.59 diverts up to 65 cfs into the Talent Canal which begins on the east side of Bear Creek.
- Phoenix Canal Diversion Dam at RM 16.8 delivers water into the Phoenix Canal with a maximum of 102 cfs on the west side of Bear Creek. The Phoenix Canal also receives up to 49 cfs from Little Butte Creek drainage by siphon from the Medford Canal. The maximum capacity of the Phoenix Canal at the junction is 75-85 cfs.

- Jackson Street Diversion Dam at RM 9.5 diverts into a short canal on the west side that connects with the 50 cfs capacity Hopkins Canal before it crosses Bear Creek by siphon. The Hopkins Canal also carries water from Little Butte Creek drainage.

Table 2-6 shows annual diversions in Bear Creek drainage by the three irrigation districts for water years 1990 through 1999. The average annual diversion during the irrigation season by the three districts for these ten years was 70,000 acre-feet.

Table 2-6. Annual MID, TID, and RRVID Diversions in Bear Creek Subbasin for Water Years 1990-1999 (acre-feet)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Upstream from Emigrant Reservoir										
Ashland Canal	10,300	7,600	6,300	6,200	8,300	6,100	8,100	9,400	7,100	6,900
Directly from Emigrant Reservoir										
East Canal	36,700	29,500	26,200	28,700	32,700	29,300[1]	34,600	33,100	38,700	39,700
Downstream from Emigrant Reservoir Diverted From Bear Creek										
Talent Canal	8,300[2]	13,800	8,800	12,500	11,200	14,000	13,500	14,000	13,500	15,500
Phoenix Canal	13,000	14,900	4,800[3]	11,200	7,000	11,700	10,100	9,800	10,600[3]	14,500
Hopkins Canal	4,100	4,200	5,200	6,700	8,600	7,900	8,200	8,900	7,900	6,800
Total	72,600	70,000	50,900	65,500	67,800	69,000	74,500	76,700	72,200	80,900

[1] Partial data for June 1995 and significant missing data for July 1995 but data estimated.
[2] Missing data for May and June 1990.
[3] Partial data for June and July 1992 and missing data for May 1998.
Source: Vinsonhaler 2002

2.5.2 Antelope Creek/Dry Creek Areas

The Antelope Creek/ Dry Creek Areas includes the following facilities:

Water Collection and Storage Facilities

- Water collection facility on Antelope Creek

- Storage regulating facility on Dry Creek

Water Conveyance Facilities

- Antelope Feeder Canal
- Agate Feeder Canal

Water Collection and Storage Facilities

Vinsonhaler 2002, table 3-1, pages 3-5 through 3-7 shows collection and storage facilities of the Rogue River Basin Project.

Water Collection Facility

Antelope Creek Diversion Dam on Antelope Creek at RM 7.0, diverts up to 50 cfs into a connector canal extending about 0.1-mile to Hopkins Canal. Flow from Antelope Creek conveyed to Hopkins Canal are mingled with any flow in the canal and then water can be diverted at a bifurcation structure to Agate Reservoir. An estimated 1,400 acre-feet is diverted annually from Antelope Creek.

A minimum flow of 1 cfs must pass downstream from Antelope Creek Diversion Dam for streamflow maintenance from November-March. From April-October, 2 cfs or the natural streamflow, whichever is the lesser, must be bypassed for streamflow maintenance and senior water rights

Water Storage Facility

Agate Dam and Reservoir, located on Dry Creek in the Rogue River basin, stores and re-regulates water from Antelope Creek, natural flows of Dry Creek, and water conveyed from North and South Forks of Little Butte Creek. Agate Dam and Reservoir (total capacity 4,780 acre-feet; active capacity 4,670 acre-feet). The dam and reservoir are operated by RRVID as a storage-reregulating facility.

Water can be stored in Agate Reservoir at any time and at any rate consistent with downstream rights. There is no flood control operation as the reservoir is kept as full as possible. Water released from Agate Dam into Dry Creek flows a short distance downstream and then is diverted into Hopkins Canal for irrigation uses on RRVID lands on both the east and west side of Bear Creek. Dry Creek flows into Antelope Creek downstream then into Little Butte Creek at RM 3.2, downstream from Eagle Point.

Releases from Agate Reservoir of 1 cfs for streamflow maintenance in Dry Creek are made when inflow is equal to or greater than that amount. If inflow is less than 1 cfs, then that is released for streamflow maintenance. These releases are made through a 6-inch bypass line in the outlet works.

2.6 Maintenance

With the exception of Green Springs Powerplant, the irrigation districts have the responsibility for the maintenance of all Project facilities.

2.6.1 Inspection

All project facilities are subject to ongoing inspection programs. Dams identified as high significant risk to downstream population in the event of a failure, are examined every three years and an underwater inspection of the outlet works and spillway stilling basins by divers is typically conducted every six years. Diversion and delivery facilities, and dams characterized as low hazard are examined at least every six years.

Green Springs Powerplant penstock intake is periodically examined by divers. Flow through the penstock must be stopped to conduct this examination.

2.6.2 Routine Maintenance

The irrigation districts maintain the transferred works of the Project. Routine maintenance is preformed in accordance with state and Federal laws. To the extent possible, most maintenance is completed during the nonirrigation season. At times it may be necessary to work within the stream channel but an effort is made to minimize this work. Any extraordinary maintenance will be consulted on separately.

Fish screens and passage facilities are maintained according to the various Designer's Operating Criteria documents. Fish screens are removed every year and the headgates closed as a precaution against damage from high runoff.

The maintenance program may include, but is not limited to the following activities:

- repair eroded concrete
- recoat or replace corroded metal work

- repair cavitation damage to control gates
- remove sediment, rock and debris from intake and outlet works
- stabilize embankments
- reshape canals
- replace rip rap
- remove trees and debris
- repair structures at creek crossings
- maintain access roads and right of way fencing
- noxious and aquatic weed control

2.6.3 Green Springs Powerplant

Reclamation maintains the reserved works of Green Springs powerplant and its appurtenant facilities including Tyler Creek bypass channel. Routine maintenance is done in accordance with state and Federal laws. Maintenance items include but are not limited to:

- turbine and transformer upkeep
- tailrace upkeep
- stabilize embankments

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3.0 Listed Species Potentially Affected by the Proposed Action

3.1 Introduction

This chapter provides a description of each listed species potentially affected by the proposed action, ESA status, and life history. Table 3-1 summarizes this information.

Table 3-1. ESA Federally Listed and Proposed Species for Consultation and Conferencing on Rogue River Basin Project O&M

Common Name	Status	Scientific Name	Occurs in Rogue River Basin?	Occurs in Klamath River Basin?
Southern Oregon/Northern California Coasts ESU coho salmon [1]	T	*Oncorhynchus kisutch*	yes	yes
Lost River sucker[2]	E	*Deltistes luxatus*	no	yes
Shortnose sucker[2]	E	*Chasmistes brevirostris*	no	yes
Bull trout[4]	T	*Salvelinus confluentus*	no	yes
Northern spotted owl[1]	T	*Strix occidentalis caurina*	yes	yes
Bald eagle	T	*Haliaeetus leucocephalus*	yes	yes
Canada lynx[4]	T	*Lynx canadensis*	no	no
Applegate's milk-vetch[4]	E	*Astragalus applegatei*	no	yes
Gentner's fritillary	E	*Fritillaria gentneri*	yes	no
Large-flowered woolly meadowfoam[3]	E	*Limnanthes floccosa ssp. grandiflora*	yes	no
Cook's lomatium[3]	E	*Lomatium cookii*	yes	no
Vernal pool fairy shrimp[2]	T	*Branchinecta lynchi*	yes	no

E Endangered species as defined in ESA Section 3, 16 U.S.C.S § 1532
T Threatened species as defined in ESA Section 3, 16 U.S.C. § 1532

[1] Critical habitat has been designated
[2] Critical habitat has been proposed
[3] Designation of critical habitat has been deferred
[4] These species are not found in the action area and are only briefly addressed in this chapter of the BA

3.2 SONCC Coho Salmon

3.2.1 ESA Status

NMFS (Federal Register 62:24588) listed SONCC coho salmon (*Oncorhynchus kisutch*) as threatened on May 6, 1997, under provisions of the ESA. This evolutionarily significant unit (ESU) of coho salmon inhabits coastal rivers and streams between Cape Blanco in southern Oregon to Punta Gorda in northern California. Most of the remaining natural production in this coho salmon ESU takes place in the Rogue, Klamath, Trinity, and Eel River basins (Figure 3-1). The Rogue River basin and Klamath River basin contain naturally reproducing populations of this coho salmon ESU.

NMFS published a final rule designating critical habitat for SONCC coho salmon effective June 4, 1999, which encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon inclusive. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho salmon (Federal Register 64:24049). Inaccessible reaches are those above specific dams as identified in Table 6 of the Federal Register [Iron Gate Dam, Emigrant Dam and Agate Dam] or above longstanding naturally impassable barriers (natural waterfalls in existence for at least several hundred years) (Federal Register 64:24049).

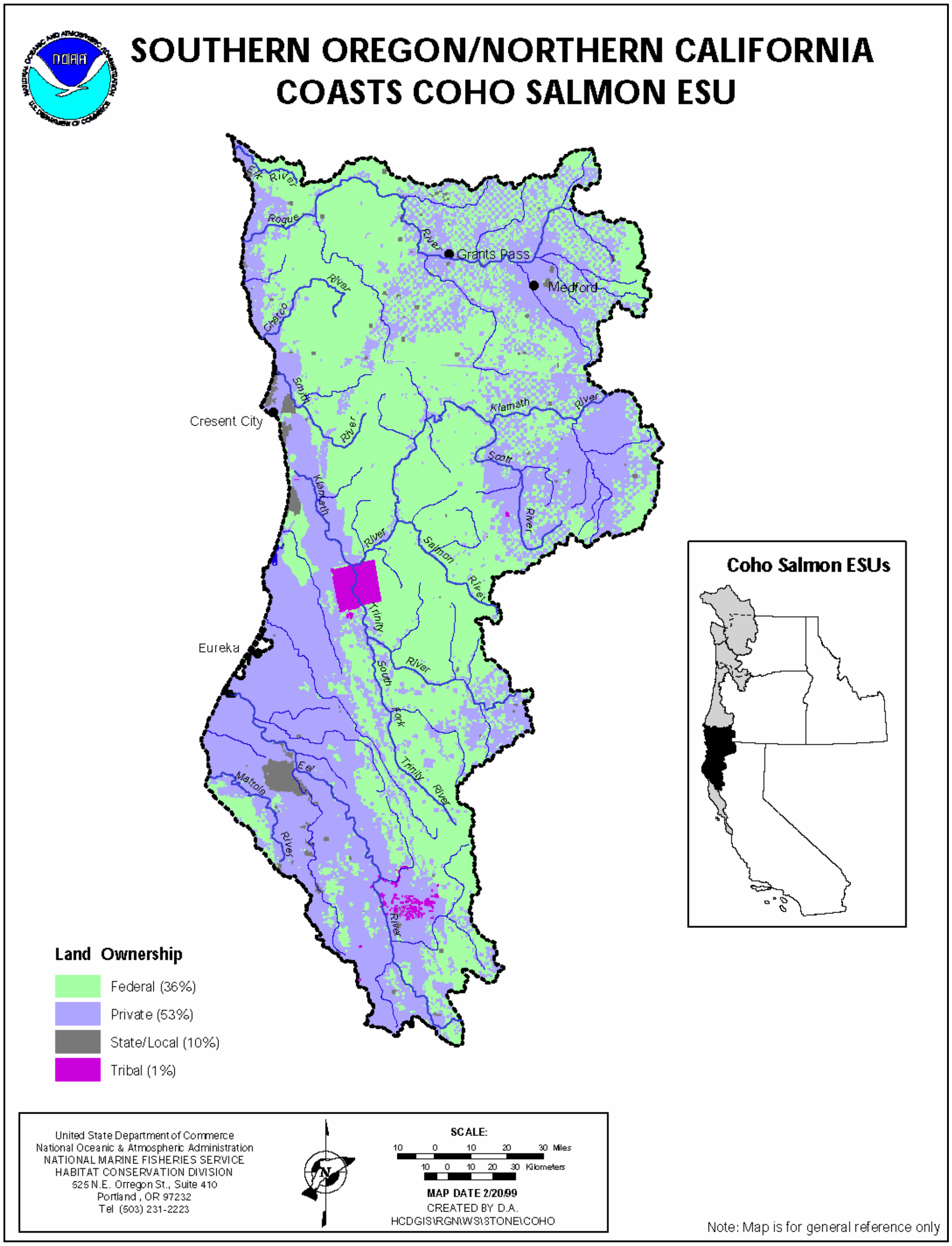

Figure 3-1. Southern Oregon/Northern California Coasts Coho Salmon ESU.

3.2.2 Location

Rogue River Basin

The SONCC coho salmon occur throughout the Rogue River basin in southern Oregon. This analysis focuses on coho salmon runs in Bear Creek and its tributaries downstream from Emigrant Dam, South Fork Little Butte Creek downstream from the waterfalls on South Fork Little Butte Creek to the confluence with North Fork Little Butte Creek, mainstem Little Butte Creek, Antelope Creek, and continuing downstream to the confluence with the Rogue River.

Klamath River Basin

Anadromous salmonids in the Klamath River are restricted to the mainstem Klamath River and tributaries below Iron Gate Dam. No passage facilities exist at Iron Gate Dam. This analysis focuses on the mainstem Klamath River downstream from Iron Gate Dam, located at approximately RM 190, in northern California.

3.2.3 Life History Summary

In contrast to the life history patterns of other Pacific salmonids, coho salmon generally exhibit a relatively simple three-year cycle. They spend approximately 18 months in fresh water and 18 months in salt water. Adult coho return to fresh water to spawn primarily as three-year old fish although some will return as two-year old precocious males (jacks or grilse) (Leidy and Leidy 1984). The percent of jacks within a run can vary greatly from year to year. Coho jacks are not sterile and can actively spawn and fertilize eggs. In some rare cases a female may return as a two-year old (Scott and Crossman 1973).

Adult coho salmon migrate into the Rogue and Klamath Rivers from September through January. Fish will hold in the estuary with upstream movement usually triggered by increased flows due to fall rains (Scott and Crossman 1973; Sandercock 1991). Upstream movement occurs during the day. In general, earlier migrating fish spawn farther upstream within a basin than later migrating fish, which enter rivers in a more advanced state of sexual maturity (Sandercock 1991).

Coho salmon normally spawn in tributary streams from November through February (peaking in January) (Table 3-2). Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools with suitable water depth and velocity.

Coho salmon eggs incubate for approximately seven weeks between November and March (Scott and Crossman 1973). The duration of incubation depends on ambient water temperature, usually between 4.4 and 13.3 °C (39.9 and 55.9 °F) (Hassler 1987). Fish remain in the gravel as fry for about 2-3 weeks until yolk is absorbed, then emerge as free-swimming actively feeding fry (Scott and Crossman 1973). Emergence typically occurs from February to mid May.

Most coho salmon young remain in freshwater for at least one year before migrating to the ocean. Juvenile coho salmon will initially take up residence in shallow, gravel areas near the streambank (Scott and Crossman 1973). Later in the summer fish will move into deeper pools seeking slow moving water and structure for cover. Fish activity, feeding, and growth rates are dependent on water temperature. Preferred rearing temperatures of 11.7 to 14.4 °C (53 to 58 °F) (Bell 1990) allow fish to grow quickly, as they feed primarily on insects (Scott and Crossman 1973, Sandercock 1991). Young coho salmon also eat other smaller fish when available (Scott and Crossman 1973, Sandercock 1991).

Juvenile coho salmon normally rear in streams about 15 months and begin migration to the ocean during their second spring. Peak smolt migration seems to occur in May. Timing of migration varies among individuals based on physiological development and fish size and other variables such as photoperiod, streamflow, and water temperature (Craig 1994). Rate of downstream migration appears to be related to size, larger fish travel faster (USFWS 1992). Once smolts reach the estuary, they spend up to one month in tidewater acclimating to salt water before entering the open ocean. The fish will then spend two summers growing at sea before returning to spawn. Coded-wire tag returns from SONCC coho salmon captured during their second year at sea have been mostly recovered off the California coastline indicating a southerly migration pattern (Federal Register 62:24588).

Table 3-2 illustrates the normal coho salmon life-cycle phases when the fish are in freshwater.

Table 3-2. Freshwater Coho Salmon Life Cycle

Life Stage	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Spawning												
Egg Incubation/Fry Emergence												
Juvenile Rearing												
Smolt Outmigration												

Source: Prevost et al. 1997, Leidy and Leidy 1984

Rogue River Coho Salmon Runs

The Rogue River coho salmon run consists of returns from both stream spawning fish (natural/wild production) and upper basin hatchery releases. Adult coho salmon begin entering the Rogue River in September.

The early October run of middle and upper basin fish pass over Gold Ray Dam on the Rogue River at RM 127.7 (just downstream from Bear Creek's confluence with Rogue River) (Prevost et al. 1997). A substantial component of this run returns to the Cole M. Rivers Hatchery (Jacobs et al. 2000).

Table 3-3 lists the annual number of coho salmon counted passing through the fish ladder at Gold Ray Dam from 1942 to 2000 (Ritchey 2001). Coho salmon are tallied passing the dam from September 15 to January 30. The adult run for the latest 10-year period averaged 10,618 fish with hatchery fish comprising 77 percent of the run. The year 2000 return of 28,791 hatchery and wild coho salmon was a record run. Since hatchery coho salmon first began to return in 1977, hatchery production has provided a majority of the spawner escapement to the upper river. An exception occurred in 2000 when wild coho salmon returns outnumbered hatchery fish.

Final counts in 2001 and 2002 were not completed as of March 2003, but preliminary estimates indicate that approximately 28,000 total adult coho salmon passed Gold Ray Dam in 2002 (Pellissier 2003). Principal tributary streams upstream from Gold Ray Dam where wild coho salmon return to spawn are Little Butte Creek, Trail Creek, Big Butte Creek, and Elk Creek.

Table 3-3. **Adult Coho Salmon Passage at Gold Ray Dam**

Year	Wild Number	Percent	Hatchery Number	Percent	Total	Total Jacks < 20 inches	Hatchery Jacks < 20 inches
1942	4,608	100			4,608	217	
1943	3,290	100			3,290	201	
1944	3,230	100			3,230	336	
1945	1,907	100			1,907	84	
1946	3,840	100			3,840	211	
1947	5,340	100			5,340	166	
1948	1,764	100			1,764	85	
1949	9,440	100			9,440	406	
1950	2,007	100			2,007	237	
1951	2,738	100			2,738	230	
1952	320	100			320	7	
1953	1,453	100			1,453	134	
1954	2,138	100			2,138	231	
1955	480	100			480	46	
1956	421	100			421	23	
1957	1,075	100			1,075	77	
1958	732	100			732	84	
1959	371	100			371	18	
1960	1,851	100			1,851	94	
1961	232	100			232	2	
1962	457	100			457	0	
1963	3,831	100			3,831	318	
1964	168	100			168	0	
1965	482	100			482	12	
1966	178	100			178	0	
1967	89	100			89	0	
1968	149	100			149	0	
1969	530	100			530	0	
1970	160	100			160	65	
1971	181	100			181	0	
1972	185	100			185	0	
1973	193	100			193	0	
1974	146	100			146	0	
1975	154	100			154	3	
1976	44	100			44	17	
1977	12	2	510	98	522	15	
1978	244	32	512	68	756	116	
1979	201	12	1,543	89	1,744	1,555	
1980	1,629	29	3,988	71	5,617	2,631	
1981	2,683	40	4,042	60	6,725	577	
1982	597	89	73	11	670	475	
1983	796	53	697	47	1,493	748	
1984	2,139	66	1,097	34	3,236	469	

Year	Wild Number	Percent	Hatchery Number	Percent	Total	Total Jacks < 20 inches	Hatchery Jacks < 20 inches
1985	459	39	711	61	1,170	348	
1986	1,474	36	2,598	64	4,072	647	
1987	1,527	28	3,868	72	5,395	960	
1988	3,558	52	3,324	48	6,882	643	
1989	268	19	1,133	81	1,401	141	
1990	212	30	485	70	697	62	
1991	195	8	2,367	92	2,562	253	
1992	0	0	4,006	100	4,006	920	
1993	756	22	2,730	78	3,486	1,698	
1994	3,265	31	7,434	69	10,699	1,525	1,077
1995	3,345	25	10,173	75	13,518	1,404	832
1996	2,554	19	11,045	81	13,599	2,055	1,228
1997	4,566	29	11,184	71	15,750	1,152	694
1998	1,310	22	4,734	78	6,044	1,284	1,034
1999	1,417	18	6,305	82	7,722	1,282	956
2000	15,652	54	13,139	46	28,791	6,332	3,652
10-year average	3,306	23	7,312	77	10,618	1,791	1,353
Average all years	1,746	72	4,071	28	3,402	519	1,353
Source: Ritchey 2001							

Naturally spawning fish typically hold in the mainstem Illinois and Rogue Rivers to await fall rains and higher flows before ascending smaller spawning tributaries. Spawning can occur from November into February depending on the sufficiency of flow conditions. Figure 3-2 illustrates the variation in coho spawn timing in recent years for streams in Oregon. The South Coast figure is for streams surveyed mostly in the middle and upper Rogue River basin.

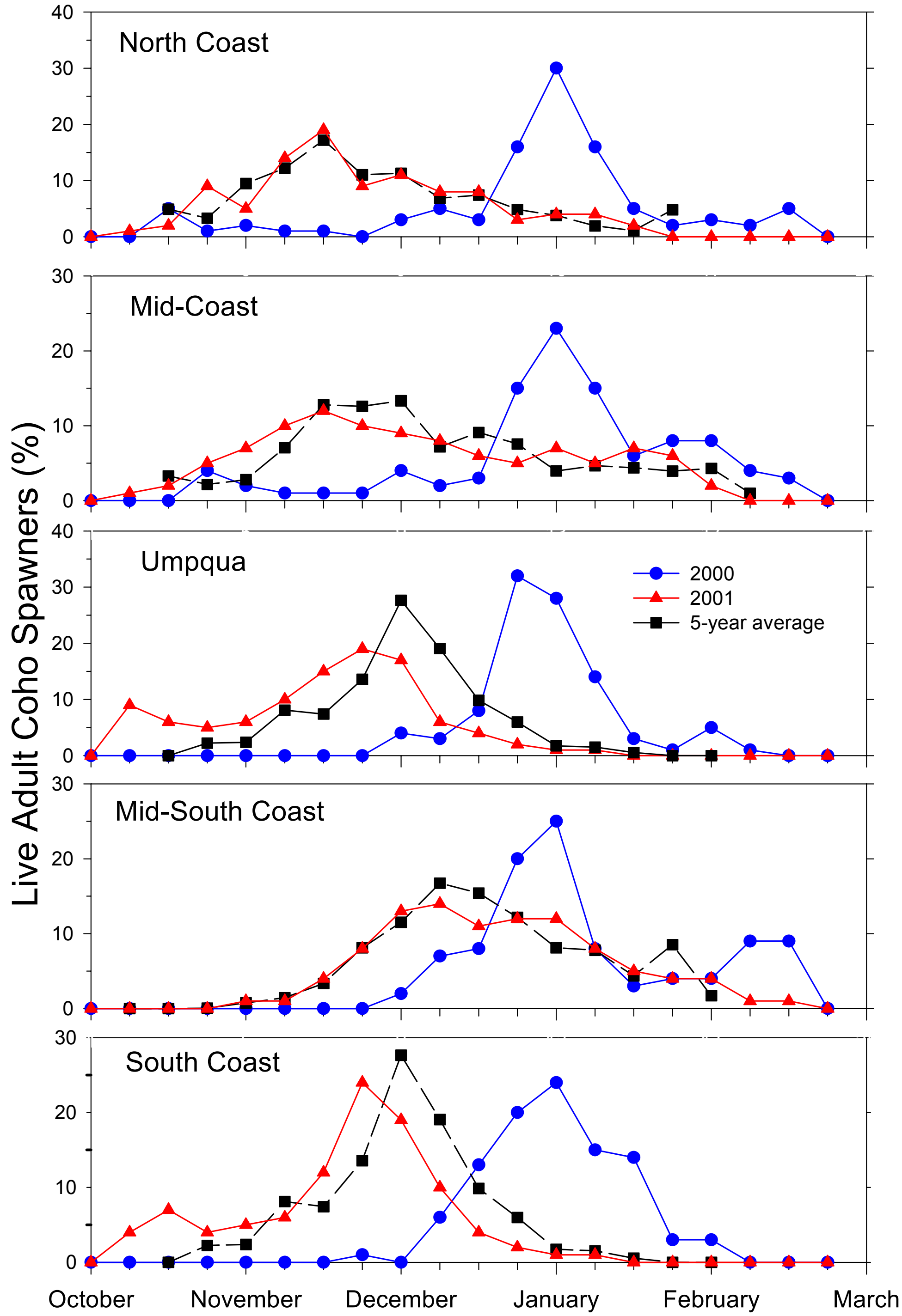

Figure 3-2. Periods of Natural Coho Spawning Observed in Oregon Coastal Streams (Jacobs 2003)

Rogue River Coho Salmon Hatchery Production

The Cole M. Rivers Hatchery began operations in 1975 and is the only hatchery that produces coho salmon for release in the Rogue River. The hatchery is located on the Rogue River at the base of Lost Creek Dam about 153 river miles from the ocean. It was built to mitigate for wild salmon and steelhead losses associated with construction of the U.S. Army Corps of Engineers' (USACE) Lost Creek Dam, Applegate Dam, and the partially completed Elk Creek Dam.

The USACE's goal to annually return 2,060 adult hatchery coho salmon is accomplished by rearing and releasing 200,000 hatchery smolts at 10 fish per pound (ODFW 1998). The NMFS' ESA 4(d) rule and hatchery operation protocols allow for substantial use of wild coho salmon trapped at the hatchery (up to 15 percent of the total estimated wild return to the entire Rogue River basin) for broodstock (Frank 2000). This program is managed principally to maintain an artificial reserve of SONCC coho salmon in the Rogue River that can be used for additional recovery actions in the future if deemed appropriate (ODFW 1998).

To implement the coho salmon hatchery production program, 150 male and 150 female adult spawners (150 pairs) are used in the egg take. Coho salmon return to the hatchery collection trap from October through January and annual returns vary widely. Female spawners average 8-9 pounds with males averaging 10-11 pounds. Protocol guidelines call for spawning 75 ripe pairs before and 75 pairs after December 15. Typically, many excess hatchery origin fish are culled to charitable organizations and, more recently, carcasses are being placed in select tributaries for nutrient enrichment (Frank 2000). Wild fish returning to the hatchery trap in excess to broodstock needs are liberated into natural spawning areas upstream from Gold Ray Dam.

Each year's egg batch is raised in the controlled hatchery environment for about 16 months. Prior to release to the river as smolts, 150,000 fish are marked with an adipose fin clip only, 25,000 are adipose clipped and implanted with a coded-wire tag, and 25,000 are marked with a coded-wire tag only (NMFS 1998). The adipose clip is an external mark so fishermen can identify the hatchery fish component available for harvest in marine or river sport fisheries. All 200,000 smolts are released each year directly to the Rogue River at the hatchery location around May 1. Hatchery raised coho salmon are released in no other Rogue River basin locations.

Klamath River Coho Salmon Runs

Adult coho salmon migrate into Klamath River from mid-September through mid-January (Leidy and Leidy 1984, Shaw et al. 1997). Fish destined for Iron Gate Hatchery first arrive in early October with the greatest number arriving around the first of November (FishPro 1992). Coho salmon returns to Iron Gate Hatchery have been recorded since 1963 and have ranged from zero fish in 1964 to 2,893 fish in 1987 (Pisano 1998). Between 1992 and 2000, an annual average of 1,205 adult coho salmon were enumerated at Iron Gate Hatchery (NMFS 2002). Typically, all returns to Iron Gate Hatchery are ready to spawn by the first of January (FishPro 1992).

Klamath River system coho salmon normally spawn in tributary streams from November through February with spawning peaking in January (Leidy and Leidy 1984). However, coho salmon have been observed spawning in side channels, tributary mouths, and shoreline margins of mainstem Klamath River between Independence Creek (RM 86) and Beaver Creek (RM 150) (Shaw 1996). Adult coho salmon and coho salmon redds are occasionally observed during Chinook salmon spawning and carcass surveys in the Klamath River. For example, in 2001, six redds with adult coho salmon holding nearby were observed in the mainstem Klamath River between Iron Gate Dam and Interstate 5 (NMFS 2002).

Klamath River basin coho salmon outmigrate from February through mid-June (Leidy and Leidy 1984, Weitkamp et al. 1995). The peak downstream movement usually occurs between April and May (Leidy and Leidy 1984). The USFWS operates downstream juvenile migrant traps on the mainstem Klamath River. Trapping at the Big Bar Rotary Screw Trap on the Klamath River (RM 48) during the spring of 1994 collected smolt coho salmon from March through June with peak numbers observed in mid-May (Craig 1994). Timing of the peak is consistent with observations from trapping conducted in 1988 and 1989 (USFWS 1992). The Big Bar Trap caught an annual average of 548 smolts (range 137-1,268) between 1991 and 2000 based on abundance indices developed for juvenile coho salmon (USFWS 2000a).

Klamath River Coho Salmon Hatchery Production

Iron Gate Hatchery released an average of about 150,000 coho salmon from 1987 to 1991. Klamath River coho salmon runs are now composed largely of hatchery fish although there still may be wild runs remaining in some tributaries. Stock transfers, because of the predominance of hatchery stocks in Klamath River basin, into the Trinity and Iron Gate Hatcheries may have had a substantial impact on natural populations in the Klamath basin. (Federal Register 64:24049)

3.3 Lost River and Shortnose Suckers

3.3.1 ESA Status

The Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostris*) were federally listed by USFWS under the ESA as endangered on July 18, 1988 (Federal Register 53:27130). These large, long-lived suckers are endemic to the Upper Klamath River basin of Oregon and California. USFWS published a proposed rule designating critical habitat for Lost River and shortnose suckers on December 1, 1994 (Federal Register 59:61744). No final rule for critical habitat has been completed as of the date of this BA.

3.3.2 Location

Currently, there are three major populations of shortnose suckers in the Upper Klamath basin found in Upper Klamath Lake, Clear Lake, and Gerber Reservoir. There are two major populations of Lost River suckers in the Upper Klamath basin found in Upper Klamath Lake and Clear Lake, along with a very small population in Tule Lake. Upper Klamath Lake contains the largest populations of shortnose suckers and Lost River suckers. (USFWS 2002)

Shortnose suckers may spawn successfully in tributaries to Iron Gate Reservoir as documented by the presence of sucker larvae in 1998 and 1999. However, the species of sucker larvae could not be identified, and it is not known which sucker species was successful. Shortnose sucker spawning may also occur in the Klamath River downstream from Copco 2 Reservoir in Iron Gate Reservoir.

The Klamath River reservoir population receives individuals carried downstream from upper reaches of the river, but they are isolated from the Upper Klamath basin by dams and show no evidence of self-sustaining reproduction (USFWS 2002).

Iron Gate Reservoir

Iron Gate Reservoir is the most downstream reservoir on the Klamath River extending from RM 198.6 to RM 190. The dam was constructed in 1962 and does not possess a fish ladder or juvenile bypass system. Iron Gate Reservoir has a surface area of 944 acres with a shoreline distance of about 19 miles. Maximum depth is about 160 feet but much of the reservoir is more than 35 feet deep with steeply sloped banks. Only small isolated pockets of wetland vegetation exist around the perimeter of the reservoir.

Iron Gate Reservoir has two perennial tributaries, Fall and Jenny Creeks, and two intermittent streams, Camp and Scotch Creeks. Approximately 1.5 miles of Klamath River flows between the upper end of Iron Gate Reservoir and Copco 2 Reservoir.

Jenny Creek flows into Iron Gate Reservoir from the north. The lower 2 miles of Jenny Creek are accessible to suckers migrating from the reservoir. Two waterfalls block upstream fish passage beyond this point. Elevation at the creek mouth is 2375 feet.

3.3.3 Life History Summary

The Lost River and shortnose suckers occur only in the Klamath River basin. Both species reside primarily in the deeper water of lake habitats and spawn in tributary streams or at springs within lake habitat. These are long-lived species, living over 30 years. (Federal Register 67:34422)

Sucker spawning can begin as early as February and continue through May. Tributary spawning generally occurs in riffle areas with moderate current and gravel/cobble substrates. The small eggs hatch in about 1-2 weeks and then remain in the substrate another week. After absorbing most of their yolk, the larvae swim out of the gravel and migrate downstream. Larval and early juvenile suckers occupy shoreline habitats while older juveniles and adults use offshore areas.

No information is available on sucker spawning or rearing in Jenny Creek.

The life history of the Lost River and shortnose suckers is included by reference (USFWS 2002). Other extensive detailed background information on Lost River and shortnose suckers and their proposed critical habitat is incorporated by reference into this BA. This information is found in:

- biological assessments (Reclamation 1992, 1994, 1996, 2001a, 2002)
- biological opinions (USFWS 1992, 1994, 1996, 2001a, 2002)
- 1993 Sucker Recovery Plan (USFWS 1993)

3.4 Bull Trout

3.4.1 ESA Status

Bull trout (*Salvelinus confluentus*) were listed by USFWS as threatened, with special rules pursuant to the ESA, for the Klamath River distinct population segment on July 10, 1998 (Federal Register 63:31647). The special rules allow the take of bull trout in the Klamath River population segments if in accordance with State and Native American Tribal fish and wildlife conservation laws and regulations and USFWS approved conservation plans. (Federal Register 63:31647)

3.4.2 Location

Rogue River Basin

Bull trout are not known to exist in the Rogue River basin.

Klamath River Basin

Bull trout occur only as resident forms isolated in higher elevation headwater streams within three of the Klamath River basin watersheds: Upper Klamath Lake, Sprague River, and Sycan River (Federal Register 63:31647). In 1996, bull trout were estimated to occupy approximately 38.2 kilometers (22.9 miles) of streams in the Klamath River basin (Federal Register 63:31647). A 1997 estimate indicated that bull trout occupied approximately 34.1 kilometers (20.5 miles) of streams (Federal Register 63:31647). These areas are outside the Project action area.

3.4.3 Life History Summary

Bull trout exhibit four distinct life history forms: resident, adfluvial, fluvial, and anadromous. Bull trout feed upon terrestrial and aquatic insects, macrozooplankton, mysids, and fish, with fish being the primary diet for individuals over 4-inches long. Growth depends on the life form of the fish. Bull trout reach lengths of 4 to 6 inches within the first 2 to 3 years. Adult spawners within resident populations generally range from 6 to 12 inches long. Migratory forms attain much larger sizes. Adfluvial bull trout are the largest, ranging from 12 to 34 inches long. Fluvial bull trout range from 11 to 21 inches. The more productive environments occupied by adult migratory populations account for the size differences (University of Idaho 2001).

This BA discussion focuses on the resident life-history form of bull trout species. Information was excerpted in its entirety from Federal Register 63:31647.

Resident bull trout spend their entire lives in the same (or nearby) small, headwater stream in which they spawned and reared. Resident and migratory forms may be found together and may produce offspring exhibiting either resident or migratory behavior. Resident adults range from 150 to 300 millimeters (6 to 12 inches) total length.

Bull trout habitat requirements are more specific than other salmonids. Bull trout distribution and abundance is influenced by water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors. All life history stages are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Stream channel and flow stability is needed to maintain bull trout habitat.

Bull trout are found in the coldest water within a given watershed. Water temperatures above 15° C (59° F) are thought to limit distribution of the fish. Spawning areas are associated with cold-water springs, groundwater infiltration, and the coldest streams in the watershed.

Preferred spawning habitat consists of low gradient streams with loose, clean gravel and water temperatures of 5 to 9° C (41 to 48° F) in late summer to early fall. The size and age of bull trout at maturity depends upon life-history strategy. Resident fish grow more slowly than migratory fish and tend to be smaller at maturity and less fecund. Bull trout reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate year spawning has been reported.

Spawning occurs from August to November during periods of decreasing water temperatures. Temperatures during spawning range from 4 to 10° C (39 to 51° F) and redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater. Spawning substrate consists of loose, clean gravel relatively free of fine sediments. This condition is vital to egg survival and emergence of young. Incubation lasts from 100 to 145 days, depending on the water temperature.

Females build redds or nests at the downstream end of pools. The redds often overlap, causing females to compete aggressively for nesting sites. Females release eggs into the nest from one to three times at 10-second intervals, depositing up to 5,000 eggs. Once the eggs have been laid, the male releases sperm. The female then covers the fertilized eggs with gravel (University of Idaho 2001). Eggs generally incubate for 100 to 145 days and hatch in late winter or early spring. The incubation period requires water temperatures of 34-43 °F. Newly hatched bull trout (alevins) take 65 to 90 days to absorb their yolk sac. Emergence from the redd typically occurs in early April through May after a peak instream discharge. Water temperatures continue to play an important role in embryo and juvenile development and survival. Egg-to-fry survival rates are reported as 0-20 percent at 46-50 °F, 60-90 percent at 43 °F, and 80-95 percent at 36-41°F (University of Idaho 2001).

3.5 Northern Spotted Owl

3.5.1 ESA Status

The USFWS added the northern spotted owl (*Strix occidentalis caurina*) to its list of threatened species on June 26, 1990 (Federal Register 55:26114) and designated critical habitat on January 15, 1992 (Federal Register 57:1796). In 1992, the USFWS developed a draft recovery plan for the northern spotted owl which, to date, has not been published.

3.5.2 Location

The current range of the northern spotted owl is southwestern British Columbia, western Washington, western Oregon, and the coast range area of northwestern California south to San Francisco Bay. The majority of spotted owls are found in the Cascades of Oregon and the Klamath Mountains in southwestern Oregon and northwestern California (Federal Register 55:26114).

There is one designated critical habitat unit, OR-38, in the Project area located near Hyatt Reservoir and Howard Prairie Lake. The critical habitat unit is on BLM administered lands (Leal 2001).

3.5.3 Life History Summary

Typical habitat of the northern spotted owl occurs in mountainous areas with old growth forest characterized by multilayered canopy and uneven-aged stands with overstory trees ranging from 230 to 600 years old, however; forest age is not the primary factor determining habitat suitability.

Younger forests provide suitable habitat for spotted owls if the forest contains necessary elements such as: 60-80 percent canopy closure; a multi-layered, multi-species canopy dominated by large (>30 inches) overstory trees; an abundance of large trees with various deformities (e.g., cavities, snags); large accumulations of fallen trees and other woody debris; and adequate open space below the canopy for flight. These necessary components are most often associated with stands over 200 years in age; however, spotted owls have been observed using relatively young forests (60+ years) that contain the key components of suitable owl habitat. Younger forests containing a significant quantity of older trees and snags remaining from earlier stands that were affected by fire, wind storms, and incomplete timber cuts, are particularly likely to provide suitable spotted owl habitat (Federal Register 60:9483).

Northern spotted owls are primarily nocturnal predators of small mammals particularly northern flying squirrels (*Glaucomys sabriius*), woodrats (*Neotoma spp.*), and red tree voles (*Phenacomys longicaudus*) (Marshall et al. 1996, USFWS 1995). Spotted owls can be characterized as long-lived raptorial birds that form nesting pairs which generally remain together to breed for many years. Nesting pairs do not attempt to build a nest and breed every year and failed attempts at reproduction are not unusual. Intermittent breeding attempts may be related to fluctuations in prey availability. The owls nest in cavities or platforms created by abandoned raptor nests, squirrel nests, debris accumulations, and mistletoe brooms.

Nesting activity occurs between February and March and one to four eggs are laid shortly after nest completion. Chicks are fledged between mid-May and June but continue to receive parental care into September. At that time, the juvenile owls will be on their own. Starvation and predation by great horned owls claim the majority of the 88 percent of subadults that do not survive through their first year (Federal Register 55:26114).

Adult northern spotted owls maintain a home range territory all year. The size of their territory can vary depending on the time of year, the amount of old-growth and mature forest available, and a suitable prey base. Within Oregon, median annual pair home ranges were estimated to be 2,955 acres for the Cascades and 4,766 acres for the Coast Range (Federal Register 55:26114).

3.6 Bald Eagles

3.6.1 ESA Status

In 1967, the Secretary of the Interior listed bald eagles (*Haliaeetus leucocephalus*) south of the 40th parallel as endangered under the Endangered Species Preservation Act of 1966. Following enactment of the Endangered Species Act of 1973, the

USFWS listed the species as endangered throughout the lower 48 states, except in Michigan, Minnesota, Oregon, Washington, and Wisconsin where it was designated as threatened. Due to the overall population increase, the bald eagle was reclassified in 1995 from endangered to threatened in all 48 lower states (Federal Register 60:36000). Most recently, in 1999, the USFWS proposed delisting this species because eagle populations are rebounding significantly and overall goals of the recovery program have been met. If the bald eagle is removed from the threatened and endangered species list it will remain a protected species under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

3.6.2 Location

Five currently active bald eagle breeding territories are found within the action area at Hyatt Reservoir, Howard Prairie Lake, and near Emigrant Lake on Slide Creek. The Slide Creek nest is outside the action area but the eagles may forage at Emigrant Lake.

The nest at Hyatt Reservoir is within Cascade-Siskiyou National Monument and is managed by the BLM. The nest on Slide Creek is on BLM administered lands.

3.6.3 Life History Summary

Within the action area bald eagles are living, reproducing, and wintering around Reclamation's reservoirs. These large, open bodies of water support fish and waterfowl that are the eagle's primary prey. The surrounding forest ecosystem is also home to birds and mammals (and their carcasses) with which eagles supplement their fish diet. Forested lands surrounding the reservoirs, especially the higher elevation Hyatt Reservoir and Howard Prairie Lake, have trees suitable for nesting and perching.

Eagles generally choose to build nests in trees that occur in uneven-aged stands with old growth characteristics (USFWS 1986). Usually these trees are among the tallest in the stand allowing for an unobstructed view of a waterbody from which most of the prey is obtained. Nesting pairs often build more than one nest in their breeding territory in case the primary nest is destroyed. The same nest is often reused over successive years with the addition of nest materials. Nest trees typically have sturdy upper branches to support the large nest which is approximately 2-3 feet deep and 5 feet in diameter. Bald eagle nests in the Klamath River basin and the Cascade Range are found primarily in Ponderosa pine and secondarily in Douglas fir trees.

The breeding season for bald eagles in the Pacific Northwest generally extends from January to mid August. Chicks are usually fledged in July but may remain near the nest for several weeks after fledging. Bald eagles are extremely sensitive to human disturbance during the breeding season. Human activities are known to cause abandonment of nests and failed attempts at reproduction (USFWS 1986).

Habitat for bald eagles outside the breeding season consists of daytime perches and nighttime communal roosts. A good perch site is one located close to a food source and has a clear view of the surrounding area. Nighttime communal roosts are near food sources, offer more protection from the elements than daytime perches, and are isolated from human disturbance. Eagles will use artificial perches where suitable natural perches are unavailable (USFWS 1986).

3.7 Canada Lynx

3.7.1 ESA Status

The contiguous U.S. population of Canada lynx (*Lynx canadensis*) was listed by USFWS as threatened on March 24, 2000, under the ESA. The U.S. listing extends protection to Canada lynx in 13 states including Oregon. USFWS determined establishing critical habitat is beneficial for the conservation of Canada lynx and will designate critical habitat in the future. A recovery plan has not yet been developed (Federal Register 65:16051).

3.7.2 Location

There have been 12 verified Canada lynx records for Oregon in the past century. Based on the timeframes when collected and locations in atypical habitat, some of these records likely were dispersing transient individuals. The most recent lynx observations (post 1985) were from the Cascade Range and Blue Mountains in northeast Oregon. Based on the limited available information, the USFWS concluded that lynx have always occurred intermittently in Oregon, but they could not substantiate either an historic or current presence of a resident lynx population in Oregon. (Federal Register 65:16051)

3.7.3 Life History Summary

The large, broad feet of Canada lynx allow them to move easily in deep snow cover and pursue snowshoe hares, and therefore, they have a competitive advantage over other carnivores like bobcat and coyotes in snow. Lynx in Canada forage almost exclusively on snowshoe hare. When snowshoe hare populations are low, lynx broaden their diet to include squirrels, mice, voles, carnivores, ungulates, and birds (Verts and Caraway 1998).

The Canada lynx diet in southern extensions of their range is not well researched. The density of snowshoe hare is lower than in northern extensions of Canada lynx usage. Small mammal communities are composed of different species, and habitat is patchier than in Canada and Alaska. Biologists believe the lynx's diet differs from the nearly exclusive snowshoe hare diet of central and northern populations. Southern lynx populations consume alternate prey species opportunistically and with greater frequency (Ruediger et al. 2000).

Canada lynx primarily inhabit boreal forests of Alaska, Canada, and the northern contiguous United States (Verts and Caraway 1998). Its historic range within the lower 48 states includes southern boreal forests of the Cascade Range in Washington and Oregon. It occurs in subalpine coniferous forests at elevations receiving deep snow (Federal Register 65:16051).

3.8 Applegate's Milkvetch

3.8.1 ESA Status

Applegate's milkvetch (*Astragalus applegatei*) was federally listed by USFWS as endangered without critical habitat on August 27, 1993 (Federal Register 58:40547). An approved recovery plan for Applegate's milkvetch was published by USFWS in 1998.

3.8.2 Location

Applegate's milkvetch is restricted to flat-lying, seasonally moist, alkaline soils of the Klamath River floodplain between Klamath Falls and Keno in Klamath County, Oregon. The known occurrences of Applegate's milkvetch are east of the Klamath River, near the city of Klamath Falls. These sites are outside the Project action area.

3.8.3 Life History Summary

Applegate's milkvetch is a perennial plant species within the legume family (Fabaceae). It grows approximately 12 inches high with trailing stems 10 to 33 inches long and leaves 1.5 to 5 inches long. It reproduces only by seed during June, July, and early August. Most pollination occurs by butterflies and bees; the Melissa blue butterfly is one known pollinator. However, the anthers and stigma ripen at the same time enabling the plant to self-pollinate. The milkvetch produces pea-like flowers with lavender-tipped white petals and seed pods between 0.3 and 0.5 inches long containing three to ten dark seeds. Long distance seed dispersal is not evident. Most seedlings establish near mature plants. Some seed distribution may occur through ingestion by rodents (Federal Register 58:40547, USFWS 1998).

Astragalus species usually grow in moisture deficient environments. However, Applegate's milkvetch also grows on moderately moist soils where a hardpan layer exists. Alkaline soils (pH 7.9-9.6) are unnecessary for life history but are preferred by Applegate's milkvetch and reduce competition from other plant species (Federal Register 58:40547, USFWS 1998).

3.9 Gentner's Fritillary

3.9.1 ESA Status

Gentner's fritillary (*Fritillaria gentneri*) was federally listed by USFWS as endangered January 10, 2000, without designated critical habitat (Federal Register 64:69195). The availability of a draft recovery plan was announced by USFWS in November 2002 (Federal Register 67:70452).

3.9.2 Location

Gentner's fritillary is found only in the rural foothills of Jackson and Josephine counties, southwestern Oregon. The species occurs as single plants or in small, widely scattered clusters of plants. Gentner's fritillary grows in or on the edge of dry, open woodlands of fir or oak at elevations below about 1360 meters (4450 feet). The species is localized within a 48 kilometer (30 mile) radius of the city of Jacksonville cemetery.

3.9.3 Life History Summary

Gentner's fritillary is a perennial herb belonging to the lily family (Liliaceae). It has a fleshy bulb and a sturdy stem that grows 20-28 inches high. The stems and leaves have a blue-tinted waxy coating. The leaves are arrow shaped, grow 3-6 inches long, and are often whorled. The bell-shaped flowers are 1.4-1.6 inches long and are reddish purple with pale yellow streaks. The flowers are solitary or in groups of up to five on long pedicels. The flowering season is from April to June; however, not every plant will flower each season. Many of the plants remain dormant for one to several years and will not produce above-ground stems and flowers. Reproduction occurs when bulblets break off and form new plants (Federal Register 64:69195).

3.10 Vernal Pools and Associated ESA Listed Species

Vernal pools are seasonal (springtime) wetland features which form in shallow depressions underlain by a hard pan or clay pan layer impervious to the downward percolation of surface water. The pools hold water for a short period of time until warming springtime temperatures evaporate the water. This annual wetting and drying-out cycle, typical of the area's Mediterranean climate, favors plant species different in character and composition from nearby upland habitats and plant species found in permanent wetland ecosystems. (Federal Register 67:59884)

The ESA species associated with vernal pools are:

- Large-flowered woolly meadowfoam (3.11)
- Cook's lomatium (3.12)
- Vernal pool fairy shrimp (3.13)

Two factors influence development of vernal pools:

- Mediterranean climate with wet and dry seasons. Mild temperatures predominate during the winter-spring wet season when the precipitation rate exceeds the rate of evaporation and the pools fill. Temperatures quickly rise during the dry season, when the rate of precipitation drops far below the rate of evaporation. The pools dry out during the dry season.
- Soil layer impermeable or nearly impermeable to water. An impermeable hard pan or clay pan layer at or near the surface prevents the downward percolation of water. Trapped surface water and rainfall fills the pool depression.

Vernal pools are a prominent feature of the Agate Desert. The Agate Desert landform is characterized by a gentle mound-swale or prairie-mound topography. Agate-Winlow Complex soils hinder water percolation allowing fall and winter rains to fill the swales forming a pattern of shallow pools. The ephemral pools vary in size from 1 to 30 meters (3 to 100 feet) across, maximum depth about 30 centimeters (12 inches) (Federal Register 65:30941).

3.11 Large-Flowered Woolly Meadowfoam

3.11.1 ESA Status

The large-flowered woolly meadowfoam (*Limnanthes floccosa* ssp. *grandiflora*) was listed by USFWS as an endangered species effective December 9, 2002. Critical habitat designation has been deferred. (Federal Register 67:68004)

3.11.2 Location

Large-flowered woolly meadowfoam is known from the Agate Desert in Jackson County, Oregon. This is an 83-square kilometer (32-square mile) landform in southwestern Oregon. This plant occurs on lands owned by The Nature Conservancy, Jackson County, ODFW, city of Medford, and private landowners. Large-flowered woolly meadowfoam is not presently known to occur on Federal lands within the Project action area.

3.11.3 Life History Summary

The large-flowered woolly meadowfoam is a delicate annual in the meadowfoam or false mermaid family (Limnanthaceae). This plant typically grows 5 to 15 centimeters (2 to 6 inches) tall. Leaves are approximately 5 centimeters (2 inches) long, divided into 5 to 9 segments, and are sparsely covered with short, fuzzy hairs. The flowers, particularly the calyx (outer whorl of floral parts), are densely covered with woolly hairs. The five petals are 6 to 13 millimeters (0.2 to 0.5 inches) long, yellowish to white in color, and have two rows of hairs near each petal base.

Large-flowered woolly meadowfoam grows on the wetter, inner fringe of vernal pools. This species adapted to life in vernal pool habitats by growing, flowering, and setting seed in the short period of time while water is available in spring (Federal Register 65:30941). Populations of this plant are usually in full flower around late March to early April and set seed in late May and June. Seeds germinate as early as December and as late as the first part of March depending on precipitation (Borgias 2001).

3.12 Cook's Lomatium

3.12.1 ESA Status

Cook's lomatium (*Lomatium cookii*) was listed by USFWS as an endangered species effective December 9, 2002. Critical habitat designation has been deferred until such time as resources allow. (Federal Register 67:68004)

3.12.2 Location

Cook's lomatium is known from the Agate Desert in Jackson County and French Flat in the Illinois Valley, Josephine County, Oregon. This plant occurs on lands owned by The Nature Conservancy, ODFW, city of Medford, Oregon Department of Transportation, BLM, and private landowners. The Agate Desert is an 83-square kilometer (32-square mile) landform in southwestern Oregon. French Flat is outside the action area and is not discussed further.

3.12.3 Life History Summary

Cook's lomatium is a perennial forb in the carrot family (Apiaceae). The plant typically grows 6 to 20 inches tall from a thin, twisted taproot that often branches at ground level to produce multiple stems. The leaves are smooth, finely dissected, and strictly basal, growing directly above the taproot on the ground rather than along the stems. One to four groups of clustered, pale-yellow flowers produce boat- or pumpkin-shaped fruits 0.3 to 0.5 inches long. This species adapted to life in vernal pool habitats by growing, flowering, and setting seed in the short period of time while water is available in the spring (Federal Register 65:30941).

3.13 Vernal Pool Fairy Shrimp

3.13.1 ESA Status

The vernal pool fairy shrimp (*Branchinecta lynchi*) was listed by USFWS as a threatened species in September 1994 (Federal Register 59:48136). Critical habitat was proposed on September 24, 2002 (Federal Register 67:59884). There are three proposed critical habitat units in the Agate Desert, these units comprise a functional vernal pool complex consisting of vernal pools and mounded prairie and associated uplands (Federal Register 67:59884).

3.13.2 Location

Vernal pool fairy shrimp are found in 27 counties across the Central Valley and coast ranges of California, inland valleys of southern California, and southern Oregon. (Federal Register 67:59884)

In Oregon, vernal pool fairy shrimp are known to occur on the Upper and Lower Table Rock Preserve, north of Medford, and on a landform known as the Agate Desert, an area of approximately 32 square miles or 83 square kilometers (Federal Register 67:59884 and 67:68004). Proposed critical habitat in the Agate Desert totals approximately 2,700 hectares (about 6,700 acres) (Federal Register 67:59884). Crustacean populations occurring on lands owned by The Nature Conservancy are protected from development (Federal Register 65:30941). Upper and Lower Table Rock Preserve is outside the action area and is not discussed further.

This species has a sporadic distribution within vernal pool systems. The majority of known populations inhabit vernal pools with clear to tea-colored water, most commonly in grass or mud-bottomed swales or basalt flow depression pools in unplowed grasslands. Water in pools inhabited by this species has low total dissolved solids, conductivity, alkalinity, and chloride (Federal Register 59:48136).

3.13.3 Life History Summary

Vernal pool fairy shrimp have delicate, elongated bodies ranging from 0.4 to 1.0 inch long. They have large, stalked, compound eyes, no carapace, two pair of antennae, and 11 pairs of swimming legs. They swim upside down (ventral side up) using their legs to beat in an anterior to posterior direction. Most feed on algae, bacteria, protozoa, rotifers, and bits of detritus.

Vernal pool fairy shrimp have developed a desiccation-tolerant stage within their life cycle as an adaptation to existing within temporary bodies of water (Graham 1997). This strategy is known as cryptobiosis, an adaptation in which organisms have at least one stage in their life cycle that can tolerate extreme desiccation; some species are able to lose up to 92 percent of their body water and still survive. In ephemeral pools, cryptobiosis is usually limited to the egg or cyst stage of an animal's life history.

Branchiopod crustaceans are among the better known cryptobiotic species, having cryptobiotic cysts that pass the vernal pool dry phase in pool sediment and are extremely tolerant of heat and cold as well as prolonged desiccation. Some, but not all, of the cysts may hatch when the pools refill with rainwater. The cyst bank in the soil may be comprised of cysts from several years of breeding (Federal Register 59:48136).

Branchiopod crustacean cope with climatic variability by producing eggs with differing diapause characteristics in each clutch. Some hatch after drying and getting wet again. Others go through more than one dry and wet cycle before they hatch. It is not definitively known what other cues operate to break dormancy in addition to wetting the cysts, but water temperature, changes in oxygen levels, solute concentrations, or changes in pH may be involved for different species. Although being adapted to cope with the inherent variability of climate patterns, branchiopods can be adversely affected by more rapid shifts of environmental conditions or shifts beyond the range of normal variation (Graham 1997).

The early stages of the fairy shrimp develop rapidly into adults. These nondormant populations often disappear early in the season long before the vernal pools dry up (Federal Register 59:48136). The time required to reach maturity and start producing the next generation of viable cysts varies greatly among species, even within the same pool, depending on genetic controls and environmental influences (Graham 1997). Although vernal pool fairy shrimp can mature quickly allowing populations to persist in short-lived shallow pools, they also persist later into spring where pools are longer lasting (Federal Register 59:48136).

Chapter 4.0 Environmental Baseline

4.1 Introduction

The environmental baseline describes the impacts of past and ongoing human and natural factors leading to the present status of the species and its habitat within the action area. The environmental baseline provides a "snapshot" of the relevant species' health and habitat at a specified point in time (i.e., the present). The environmental baseline includes past and present impacts of all federal, state, and private actions and other human activities in the action area (50 CFR 402.2). The baseline also includes State, tribal, local, and private actions already affecting the species or habitat in the action area or actions that will occur contemporaneously with the consultation in progress. The environmental baseline assists both the action agency and USFWS and NMFS in determining the effects of the proposed action on the listed species and critical habitat.

4.2 SONCC Coho Salmon

All actions described as part of the environmental baseline have led to the current status of coho salmon in the Rogue River and Klamath River basins. SONCC coho salmon in this ESU experienced significant population declines through the 20th century. A host of adverse human-caused factors, in combination with natural variability in marine and freshwater environmental conditions, essentially impacted all phases of the fishes' life cycle in this ESU working steadily over time to diminish its population numbers from a range of 150,000 to 400,000 naturally spawning fish in the 1940s to about 10,000 fish at the time of the 1997 ESA listing (Federal Register 62:24588).

Watershed streams and riparian areas overall are in relatively poor condition with respect to fish habitat conditions (USFS and BLM 1997). Stream habitat degradation from road building, logging, livestock grazing, mining, irrigation diversion, urbanization, wetlands removal, channelization projects, and point and nonpoint source water pollution impact coho salmon survival in the freshwater setting. The May 6, 1997, Federal Register notice presents summary information on these factors (Federal Register 62:24588).

Hatchery and fishery management plus regulatory practices prior to the listing often worked against preservation of wild coho salmon populations.

SONCC coho salmon, along with the region's other salmon and steelhead species, historically supported major commercial and sport fisheries. In hindsight, overfishing of coho salmon was sanctioned from the mid 1970s to the mid 1990s during a time when ocean conditions were poor relative to salmon growth and survival. Commercial and sport overharvesting also contributed to the decline in coho salmon populations.

Coho salmon fisheries during this period consisted of a meager wild fish component mixed with a much more abundant, artificially produced hatchery population of coho salmon. The greater numbers of hatchery fish within these fisheries could not be distinguished from fish produced in nature. This allowed for excessive harvest on declining wild fish stocks. In 1988 this problem was eliminated when Oregon hatcheries began clipping the adipose fin of all released juvenile coho salmon (Jacobs et al. 2000) and restricting harvest of wild fish.

Fluctuating ocean conditions, in particular the Pacific Decadal Oscillation, produced alternating periods of good and poor ocean productivity and environmental conditions that affected survival of anadromous salmonids.

Ocean conditions and cold, nutrient-rich upwelling currents play an important role in overall coho salmon survival. Nutrient-rich water stimulates and enhances phytoplankton and zooplankton production which directly benefits prey animals that coho salmon feed upon. Numerous El Nino climate occurrences in recent decades have depressed upwelling currents resulting in reduced coho salmon growth rates and survival. El Nino-Southern Oscillation events are superimposed over the longer-term Pacific Decadal Oscillation to affect ocean productivity. Droughts and flooding over time added to adverse impacts to naturally occurring anadromous fish runs and caused most wild Pacific Coast coho salmon populations to be listed or considered for listing under the ESA. Rogue River basin streams inhabited by SONCC coho salmon and influenced by Project operations include Little Butte Creek and Bear Creek watersheds (Figure 4-1).

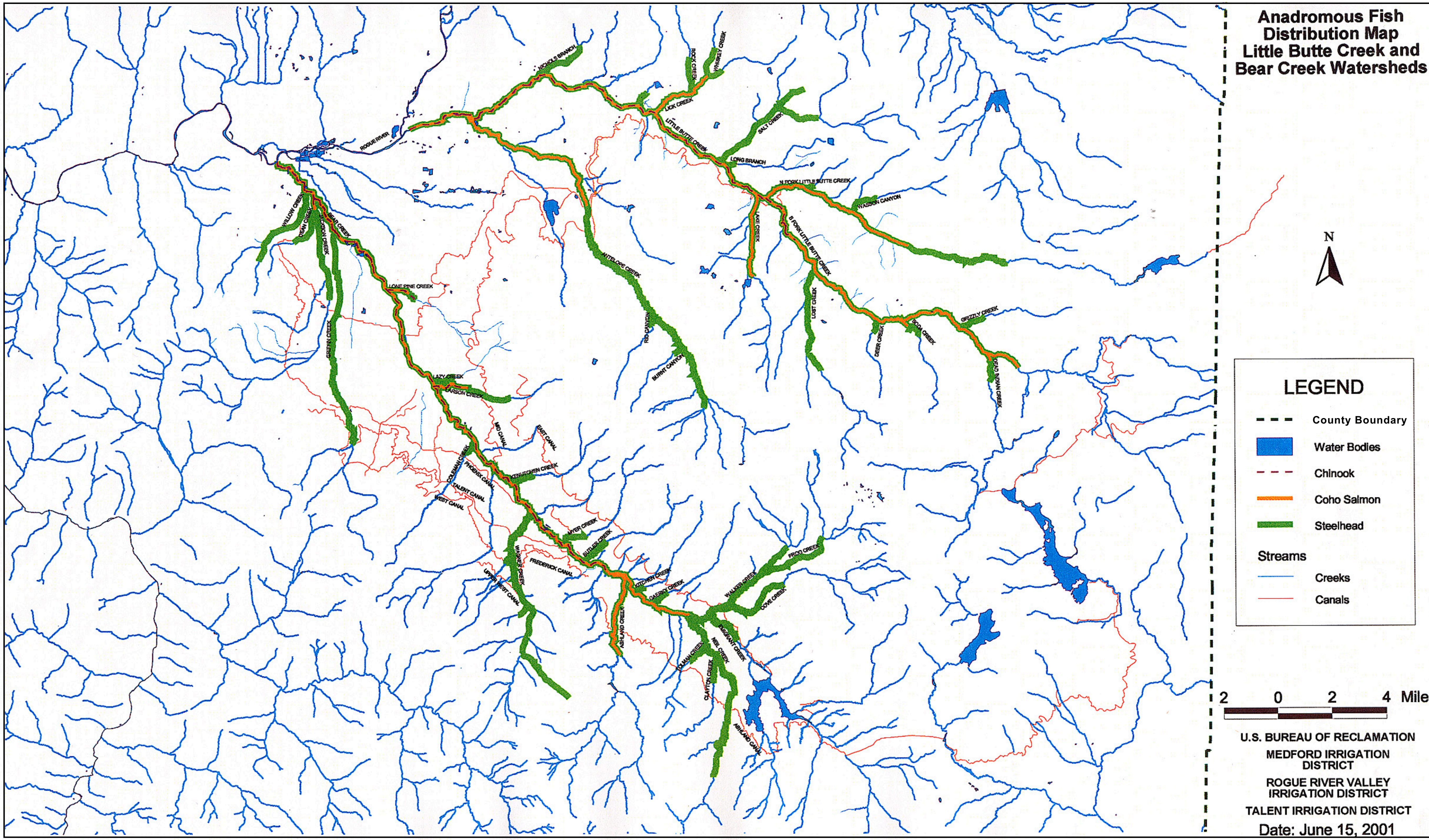
Anadromous Fish Distribution Map Little Butte Creek and Bear Creek Watersheds
N
LEGEND
County Boundary
Water Bodies
Chinook
Coho Salmon
Steelhead
Streams
Creeks
Canals
2 0 2 4 Miles
U.S. BUREAU OF RECLAMATION
MEDFORD IRRIGATION DISTRICT
ROGUE RIVER VALLEY IRRIGATION DISTRICT
TALENT IRRIGATION DISTRICT
Date: June 15, 2001

Figure 4-1

4.2.1 Rogue River Basin

Little Butte Creek Watershed

The Little Butte Creek watershed covers 238,598 acres (about 373 square miles). Bureau of Land Management (BLM) and U.S. Forest Service (USFS) manage about 114,600 acres of Federal land in the basin (48 percent) while most of the remaining (50 percent) is in private ownership. The other 2 percent is owned by the State of Oregon or is within the urban growth boundary of Eagle Point (BLM and USFS 1997). The Little Butte Creek watershed provides some of the best remaining coho salmon production in the Rogue River basin. A total of about 46 miles of known coho salmon spawning and rearing habitat exists in the Little Butte Creek watershed (Vogt 2000). The watershed contains some of the better spawning returns in the entire Rogue River basin and, for the 5 years from 1996 to 2000, this stream averaged 15 coho salmon spawners per mile (Jacobs 2001). This represents the highest average density of coho salmon spawners of all Rogue River basin areas sampled.

The Little Butte Creek surveyed reaches are randomly selected each year so the full range of spawning habitat is represented (Ritchey 2001). Once started, surveys are repeated in select reaches about every 10 days regardless of streamflow conditions. The primary objective is to count spawning coho salmon. Redds are also visually counted. Redds are not flagged, so double counting does occur. Spawned out carcasses are also tallied. This survey approach does not yield a precise estimate of spawner escapement to the stream because only randomly selected stream reaches are inventoried and observations are dependent on water clarity and flow levels. Over a period of years the method provides a relative and valuable indication of coho salmon spawning.

South Fork Little Butte Creek is a designated “coho salmon core area” as identified in the Southwest Oregon Salmon Restoration Initiative (Prevost et al. 1997) and contains about 27 miles of high value stream habitat used by native coho salmon. Coho salmon core areas are streams capable of sustaining year-round coho salmon spawning and rearing. While there may be existing habitat limitations, the resource management intent is to protect and improve these core habitats to help stabilize the basin’s native coho salmon population at a genetically viable level.

Eighteen stream reaches totaling 170.9 miles within Rogue River basin were designated as coho salmon core areas in the Southwest Oregon Salmon Restoration Initiative report (Prevost et al. 1997). This compares to a total of 110 streams and approximately 1,000 miles in the entire Rogue River basin considered to be coho salmon habitat. About 17 percent of Rogue River basin coho salmon streams are considered high value coho salmon core habitat.

Several stream reaches within the Little Butte Creek watershed, similar to other Rogue River basin coho salmon streams, are sampled annually under the ODFW Coastal Salmonid Inventory Project to assess wild adult coho salmon spawning. Sampling occurs in the North Fork, South Fork, Soda Creek, Lake Creek, and Dead Indian Creek drainages of Little Butte Creek. Sampling is done each year during the November to January spawning period (Jacobs et al. 2000). The purpose of these surveys is to gather data to help estimate Rogue River basinwide escapement and correlate the incidence of spawning with habitat conditions and smolt production.

A cooperative ODFW, BLM, and USFS coho salmon and steelhead smolt trapping project started in March 1998 validates that Little Butte Creek is an important producer of wild coho salmon (Vogt 2000). Trapping has been conducted on six upper Rogue River basin streams, including Big Butte Creek, Little Butte Creek (action area stream), West Fork Evans Creek, Slate Creek, South Fork Big Butte Creek, and Little Applegate River.

An irrigation diversion ditch near Eagle Point is fitted with a rotary fish screen, bypass pipe, and collection trap and has been used to capture downstream migrating smolts on Little Butte Creek. Rotary screw traps are used at other stream trapping locations. The sampling period runs from March 1 to June 30 if streamflow permits. Traps are checked daily. Fish are identified as to species and life stage, enumerated, and measured. To estimate trapping efficiency, a subsample of coho salmon over 2.4 inches is marked with a caudal fin clip, transported back upstream, and released. Marked fish are then recaptured to determine trapping efficiency which can be used later to estimate overall coho salmon smolt abundance in the stream. Table 4-1 (all sampled streams) and Table 4-2 (Little Butte Creek) provide upper Rogue River basin coho salmon smolt trapping data collected during 2000 and 2002 plus the corresponding total population estimate for sampled streams (Vogt 2000, Vogt 2002). Little Butte Creek had the second highest estimated coho salmon smolt production of the six streams sampled in 2000. Smolt outmigration peaked in early May at the Little Butte Creek trapping location. Population estimates increased in Little Butte Creek from 11,211 in 2000 to 35,131 in 2002 (Table 4-1 and Table 4-2).

Table 4-1. 2000 Coho Salmon Smolt Production Estimates at Each Trap Site

	Little Butte Creek	Big Butte Creek	West Creek	South Fork Big Creek	Little Creek	Slate Creek
Dates trapped	3/1-6/21	3/1-6/21	3/1-6/7	3/1-6/14	3/1-6/21	3/1-6/1
Number of days trapped	107	110	99	106	109	90
Number of coho salmon captured	3,184	3,381	111	37	8	277
Number of coho salmon marked	1,524	1,954	111	37	8	275
Number of coho salmon recaptured	433	466	3	0	2	27
Trapping efficiency (percent)	28	24	3	0	25	10
Population estimate	11,211	14,206	4,111	NA	32	2,827

Source: Vogt 2000

Table 4-2. 2002 Coho Salmon Smolt Production Estimates at Little Butte Creek

Dates trapped	3/1-6/16
Number of days trapped	108
Number of coho salmon captured	14,228
Number of coho salmon marked	2,186
Number of coho salmon recaptured	885
Trapping efficiency (percent)	41
Population estimate	35,131

Source: Vogt 2002

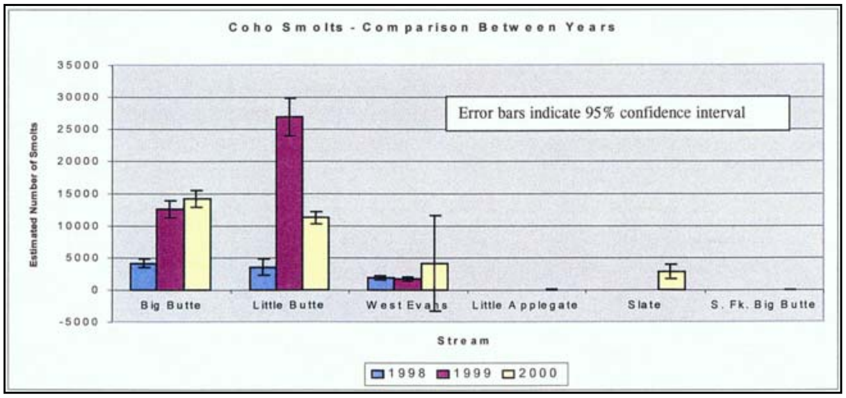

Figure 4-2. Between Year Comparison of Coho Smolt Estimates at Each Trap Site (1998-2000). Source: Vogt 2000

The bar graph in Figure 4-2 illustrates the estimated total smolt production in each of the six streams sampled in 1998-2000.

Stream Habitat Conditions

Much of Little Butte Creek and its tributaries are mostly riffle-dominated, single channeled, and lack historic side-channel and small meadow-wetland-type habitats preferred by coho salmon during juvenile rearing stages. Past management activities in the riparian zones have limited the amount of large wood recruitment (valuable for cover, pool maintenance, and fish rearing), thereby reducing stream shading and streambank stability. Streams lack quality pools, i.e., those with suitable depths and velocities. Reduced riparian vegetation causes streambanks to be less stable. Periodic large storm incidents have taken out streamside riparian vegetation; livestock grazing further impacts it (USFS and BLM 1997).

The Little Butte Creek Watershed Analysis (USFS and BLM 1997) provides extensive information on ecosystem conditions in Little Butte Creek watershed and includes information on stream habitat elements that may affect anadromous fish production.

Water Quality

The watershed currently has water quality limited stream segments on Oregon's Final 2002 303(d) List. These stream segments do not meet certain water quality criteria or support certain beneficial uses.

Oregon scheduled the upper Rogue River Basin Total Maximum Daily Load (TMDL) for completion in 2004. TMDLs determine the maximum allowable level of pollutants a water body can assimilate while supporting existing beneficial uses. TMDLs allocate pollutant loads to different sources in the watershed and set the stage for implementing corrective actions to be taken.

In 2002, ODEQ identified impaired stream segments for the 303(d) list and EPA approved the list on March 24, 2003 (ODEQ 2003). Table 4-3 shows stream segments in Little Butte Creek watershed that are included on the 303(d) list. Other stream segments in the watershed may not meet state water quality criteria but supporting data were not readily available when ODEQ developed the list.

On March 31, 2003, U.S. District Court Judge Ancer Haggerty ordered the EPA to void its earlier approval of Oregon's water temperature standards. Oregon has initiated rulemaking and is working in concert with the ODFW, EPA, NMFS, and USFWS to develop new temperature criteria. For water quality discussions in this BA, Reclamation will use Oregon's existing temperature criteria for comparison purposes.

Table 4-3. Little Butte Creek Watershed 303(d) Listed Waterbody Segments

Waterbody	Listed Segment (RM)	Pollutant
Antelope Creek	RM 0 – 19.7	temperature (summer), *E. coli* (June 1-Sep. 30),
Deer Creek	RM 0 – 3.2	sedimentation
Lake Creek	RM 0 – 7.8	temperature (summer), sedimentation, *E. coli* (year round)
Little Butte Creek	RM 0 – 16.7	temperature (summer), fecal coliform, sedimentation, dissolved oxygen (year round)
North Fork Little Butte Creek	RM 0 – 6.5	temperature (summer), *E. coli* (June 1-Sep. 30),
South Fork Little Butte Creek	RM 0-16.4	temperature (summer), sedimentation
Lost Creek	RM 0 – 8.4	temperature (summer), sedimentation
Soda Creek	RM 0 – 5.6	temperature (summer), sedimentation

Source: Oregon 2003

Temperature

Water temperature data recorded in the Little Butte Creek watershed indicate that several of the segments on the 303(d) list don't meet the water temperature criteria for salmonid rearing during the summer period. The temperature criteria is intended to protect stream rearing cold-water salmonid fish species such as trout, salmon, and steelhead. Temperature data recorded prior to the 2002 303(d) listing show these stream segments routinely had water temperatures above the summer temperature criteria (June 1 to September 30 fish-rearing period). The applicable water temperature target criteria for Little Butte Creek is a 7-day average of daily maximum temperature of 17.8 °C (64 °F) (ODEQ 1998). When conditions do exceed the target criterion, then no measurable increase 0.3 °C (32.5 °F) due to human activities is allowed. More recent sampling confirms the water temperature criterion continues to be unmet in many areas of the Little Butte Creek watershed. This is attributable in part to past practices that have:

- channelized stream segments following flooding events
- removed riparian vegetation thus reducing shading during the summer
- reduced flows during summer months

Summer stream temperatures generally correlate with elevation in the Little Butte Creek watershed; cooler temperatures are found at higher elevations (Figure 4-3). The best summer temperature conditions in the watershed, where temperatures are usually less than 17.8 °C (64 °F), are in stream segments above elevation 4000 feet. These streams are mostly on Federal land in the Little Butte Creek watershed and account for 75 to 85 percent of the viable salmonid production during the summer months (USFS and BLM 1997). However, the amount of this habitat in the watershed available for salmon and steelhead rearing appears to be quite limited. Lower elevation stream sections influenced by cool water spring discharge may provide some localized refugium and good summer rearing temperatures.

Volunteer members of the Little Butte Creek Watershed Council initiated efforts to monitor and collect water quality data (Oyung 1999). The report from the volunteer monitoring program provides monitoring data for locations (high to low elevations, upstream to downstream locations including tributaries) throughout the watershed that record real-time water temperatures (Oyung 2001). During the 1998, 1999, and 2000 summer periods, starting in mid-June through the end of September, all locations except one exceeded the ODEQ 7-day moving maximum temperature criterion of 17.8 °C (64 °F).

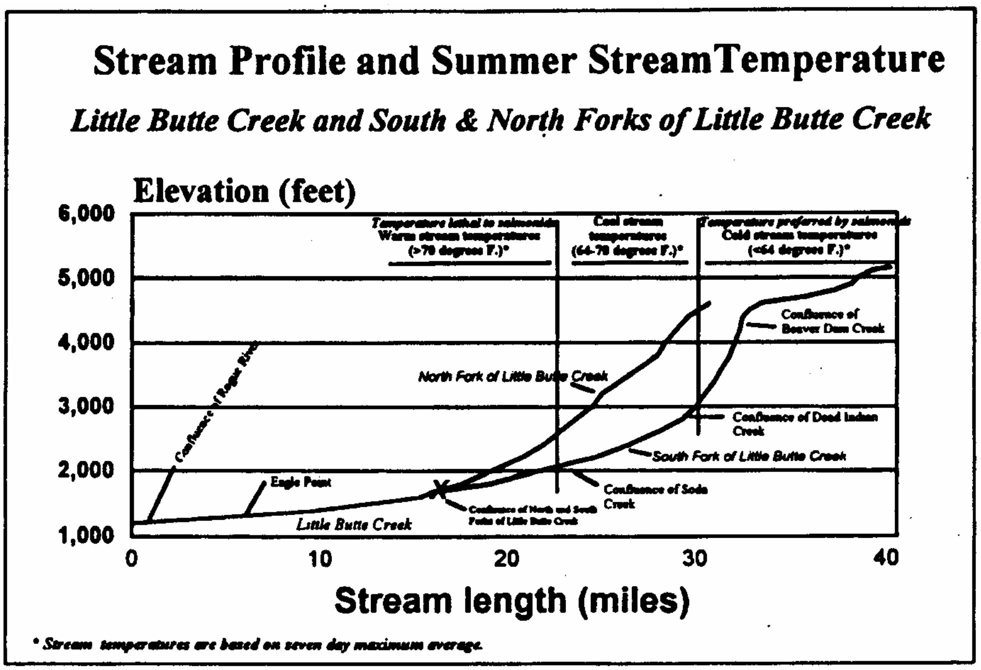

Figure 4-3. Stream Profile and Temperature Conditions in Little Butte Creek Watershed.

Bacteria

Antelope, Lake, North Fork Little Butte, and Little Butte Creeks are on the 303(d) list for exceeding bacteria criterion (fecal coliform or *E. coli*).

Sediment

Storm triggered landslides, both natural and human-caused from older clearcuts and the high number of forest roads, are a continuing source of sediment. Major rain-on-snow storm flood events in 1955, 1964, 1974, and 1997 caused both natural and road/logging related landslides and transported large amounts of sediment into streams of the Little Butte Creek watershed. These storm events caused major stream channel erosion. As a result, a high amount of fine sediment evident in the watershed's lower gradient stream reaches is embedding spawning gravels and filling pools important for juvenile fish rearing.

The 303(d) listing includes stream segments that are water quality limited for sediment. High levels of sediment adversely affect aquatic species by:

- embedding stream gravel and cobble substrates and reducing the quality and quantity of macroinvertebrate habitat
- filling in pools
- diminishing incubating salmonid egg survival by covering eggs and filling in gravel interstitial spaces with fines

Sediment contribution to streams is directly related to streambank stability, road building, and watershed vegetation conditions. The 303(d) listing for sediment was based on ODFW fish habitat surveys showing a high percentage of fine sediments in most of the stream segments.

Water Rights for Instream Flow

Oregon Water Resources Department (OWRD) issued certified water rights to ODFW for instream flow for a number of stream reaches in the Little Butte Creek watershed. ODFW made application for instream rights for reserving flow for anadromous and resident fish migration, spawning, egg incubation, fry emergence, and juvenile rearing.

ODFW used the Oregon Method for its streamflow recommendations to OWRD. The Oregon Method was developed during the 1960s and used as a basis for hundreds of instream flow reservations throughout Oregon. The method is based on field measurements of representative stream reaches that determine the minimum flow necessary to meet depth and velocity criteria for fish passage, spawning, incubation, and rearing activities (Thompson 1972). ODFW recommendations were based on biological requirements of the fish and were not adjusted for seasonal natural or man-caused flow shortages. A more robust instream flow method, such as the Instream Flow Incremental Methodology (Bovee 1982), would account for available water supplies to provide more realistic flow recommendations for different water year types (e.g., wet, average, dry years).

OWRD issued instream flow reservations in consideration of the ODFW requests. However, the resulting instream flow reservations are junior to previously issued water rights for Project and non-Project irrigation water storage and withdrawals and often can't be met, particularly in the summer and fall periods. Table 4-4 shows seasonal instream flow rights and priority dates as issued by OWRD to ODFW at four locations in the Little Butte Creek watershed. Some instream flow reservations are less than the original ODFW application.

Table 4-4. OWRD-Issued Instream Flow Water Rights for Little Butte Creek System[1] (cfs)

Stream (priority date)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Little Butte Creek at mouth (9/29/69)	120	100	100	100	100	100	100	60	60	20	20	120
Antelope Creek at mouth (9/29/69)	20	25	25	25	25	25	25	10	5	5	5	5 20
North Fork Little Butte Creek at gage 0.6 mile downstream from Fish Lake Dam (5/22/91)	8.72	16.1	16.8	14.3	16.0	19.1	32.4	34.0 20.0	20.0	13.0	13.0	11.3
North Fork Little Butte Creek at mouth (5/22/91)	13.0 18.8	20	20 34	34	34	34	34	34 20	20	13	13	13
South Fork Little Butte Creek at mouth (12/7/90)	23.2	36.6	99.2	120	120	120	120	120 70	70	47	47	38.6

[1]Some months have split instream flow rights: First half of month's flow right is the upper number; second half of month's flow right is the lower number.

Source: USFS and BLM 1997

Bear Creek Watershed

Bear Creek watershed covers 253,440 acres or 396 square miles. USFS and BLM own and manage an estimated 61,700 acres (24.3 percent). These public lands are mostly in the higher elevation headwater areas of the watershed. The entire watershed lies within Jackson County which has a population of about 175,000 people. Most of the county's population resides in the communities of Ashland, Talent, Phoenix, Medford, and Central Point. These communities border the banks of Bear Creek which is the most densely populated and intensely cultivated area in the Rogue River basin (ODEQ 2001).

Fish migrate into and throughout the Bear Creek mainstem and tributaries, and use various habitats. Historically, Bear Creek and its tributaries supported a viable and sustainable fishery for native and anadromous salmonids, including coho salmon; reaching up to the foothills (RVCOG 2001). Early newspapers chronicle fish catches of coho salmon. Habitat quality has declined since settlement from problems associated with decreased water quality, quantity, and instream barriers (RVCOG 2001). The population of coho salmon is significantly reduced from predevelopment levels in Bear Creek.

Coho salmon have historically spawned and reared in the tributaries and mainstem of Bear Creek (RVCOG 2001). Side channels and off-channel habitat (e.g., alcove pools), once abundant, and cooler stream temperatures historically were more conducive to the life-history of coho salmon. These fish must remain in freshwater habitat, generally tributary streams, for one year. Urbanization, agriculture, water withdrawals and loss of stream/floodplain connectivity in the Bear Creek watershed inhibit the recovery of coho salmon (Table 4-5).

Table 4-5. Fishery Status of Bear Creek

Stream	Fish Species: Chinook, Coho, Steelhead, Trout	In-stream Barriers	Major Limiting Factors (Flow, temp, barriers, sediment, habitat quality, connectivity to downstream impacts
Bear Creek Length: 28.8 miles	23 m. Fall Chinook 27 m. Coho 27 m. Sum Stlhd 27 m. Win Stlhd 27 m. Trout	RM 9.5* RM 16* RM 23	Water quality - temperature, agriculture, and urban stormwater run-off increases sediment and reduces water quality. Water flow during summer months reaches lethal temperatures for salmonids, with extremely low flows.

*These are diversion dams operated by TID and RRVID. Fish ladders have been constructed and diversions screened. Fish distribution data provided by Oregon Department of Fish and Wildlife, Bear Creek Distribution Query, November 15, 1999; Limiting factors identified by the Technical Committee.

Coho salmon are now considered almost extirpated from Bear Creek and its tributaries. An occasional live coho salmon or adult carcass may be found during spawning surveys. For instance, only one juvenile coho salmon was captured in 1997 and 1998 during Reclamation's (1999) summer electrofishing surveys in six sections of mainstem Bear Creek (RM 24) and six tributary reaches. Some limited evidence of past coho salmon spawning is noted in Ashland, Larson, and Lone Pine Creeks as indicated on the fish distribution map (Figure 4-1). Summer steelhead and fall Chinook salmon are more abundant and spawning is regularly documented.

Past spawning surveys and smolt production observations during the spring of 2001 (Ritchey 2001) indicate current Bear Creek and tributary flow characteristics appear to favor steelhead and fall Chinook salmon production. Steelhead are apparently better able than coho salmon to ascend and spawn in smaller tributaries where flow and habitat conditions may be somewhat better than in Bear Creek for year-round rearing. The life history of fall Chinook salmon is more adapted to mainstem Bear Creek during the fall months for spawning, springtime fry emergence, and outmigration before water temperatures become warm.

Smolt trapping in 2000-2001 captured between 27 and 100 coho smolts migrating out of Bear Creek, which is considerably below historic production potential (RVCOG 2001). ODFW estimates that coho production is approximately 3.7 coho/mile of habitat in the Bear Creek mainstem (Vogt, 2001). A rotary screw trap was temporarily installed in March 2002 near the confluence of Bear Creek with the Rogue River to collect salmon and steelhead smolts. This trap remained in place until June when flows became too low for effective operation. Only a portion of the downstream migrating fish are collected but, based on a mark-recapture estimate of numbers, overall production can be estimated. Table 4-6 summarizes the total number of downstream migrant salmonids trapped by ODFW in 2002. This indicates some limited coho salmon production is occurring.

Table 4-6. 2002 Coho Salmon Smolt Production Estimates at Bear Creek

Dates trapped	3/1-6/15
Number of days trapped	107
Number of coho salmon captured	68
Number of coho salmon marked	65
Number of coho salmon recaptured	2
Trapping efficiency (percent)	3
Population estimate	2,194

Source: Vogt 2002

Stream Habitat Conditions

Channel conditions and riparian habitat have changed due to human activities such as logging, road building, removal of riparian vegetation, channelization, beaver removal, livestock grazing, irrigation development, land alteration for agricultural, municipal, and residential developments. Connectivity of the riparian habitat has been fragmented; quantity of snags, large woody material, and streambank stability has been reduced. These changes have resulted in increased sediment to streams and reduced stream shading. Low flow conditions in unshaded stream reaches contribute to lower velocities thus increased stream temperatures. Three Bear Creek stream gages provide flow information about the mainstem; however, other stream reaches affected by irrigation water withdrawals and tributary contributions remain unmonitored (BLM 2000).

Water Quality

ODEQ (2001) has conducted water quality monitoring in the Rogue River basin since the mid-1980s and determined Bear Creek watershed is the most impacted watershed in the basin. Poor water quality conditions are the result of a high level of point and nonpoint source pollution related to dense population and urban development, intensive agriculture, and past upper watershed resource management practices. Several stream segments are on the 303(d) list of water quality limited waters (Table 4-7) for not meeting water temperature, bacteria (*E. coli*) or sediment criteria.

TMDLs in Bear Creek watershed were established in 1992 for ammonia, nitrogen, total phosphorus, and biochemical oxygen demand. Some water quality TMDL implementation activities have occurred since then. TMDLs for the Bear Creek water quality limited parameters in Table 4-7 will be developed during 2004.

Temperature

Based on investigations conducted since 1960, ODEQ determined the water temperature criterion for salmonid fish rearing is unmet in many of the 303(d) listed segments, including streams upstream from Emigrant Lake. Oregon state water temperature criterion for salmonid rearing stipulates the 7-day moving average of the daily maximum temperature shall not exceed 17.8 °C (64 °F). This criterion is intended to protect cold water aquatic life such as salmonid fish species.

Bear Creek streams routinely exceed the temperature standard during summer months (June through September), hindering juvenile coho salmon and steelhead survival. Most anadromous fish leave Bear Creek streams by July to enter the Rogue system (RVCOG 2001). Young fall Chinook salmon generally are not affected by summer temperatures because they begin migrating to the ocean shortly after emergence from gravels in the spring. Direct solar radiation on unshaded stream reaches, warm air temperatures, and extended daylight can cause daytime water temperatures to exceed 26.7 °C (80 °F) during the summer (Reclamation 2001b).

Reclamation (2001b) collected water temperature data during the summer and fall of 1998 at three locations on mainstem Bear Creek and at 15 tributary stream sites. Monitoring occurred from August 1 through the end of October to obtain hourly temperature data to monitor diurnal temperature swings and to determine exceedance of the Oregon 17.8 °C (64 °F) criterion. Temperature recorders were installed upstream from irrigated lands on Wagner, Coleman, Griffin, and Jackson Creeks both upstream from irrigated lands and at the confluence with Bear Creek to evaluate the effects of return flows on water temperature.

Table 4-7. Bear Creek Watershed 303(d) Listed Waterbody Segments

Waterbody	Listed Segment (RM)	Pollutant
Upstream from Emigrant Lake		
Carter Creek	RM 0 – 4.8	temperature (summer)
Emigrant Creek	RM 5.6 – 15.4	temperature (summer)
Tyler Creek	RM 0 – 4.0	temperature (summer)
Downstream from Emigrant Lake		
Ashland Creek	RM 0 – 2.8	fecal coliform (year round)
Bear Creek	RM 0 – 26.3	temperature (summer), fecal coliform (year round)
Butler Creek	RM 0 – 5.2	temperature (summer), fecal coliform (winter, spring, fall), dissolved oxygen (year round)
Coleman Creek	RM 0 – 6.9	temperature (summer), fecal coliform (year round), dissolved oxygen (year round)
Crooked Creek	RM 0 – 4.3	fecal coliform (year round)
Emigrant Creek	RM 0 – 3.6	temperature (summer)
Griffin Creek	RM 0 – 14.4	temperature (year round), fecal coliform (year round)
Jackson Creek	RM 0 – 12.6	temperature (year round), fecal coliform (year round)
Larson Creek	RM 0 – 6.7	temperature (summer), dissolved oxygen (Oct 1-May 31), pH (year round), fecal coliform (year round)
Lazy Creek	RM 0 – 4.5	temperature (summer), fecal coliform (year round), pH (Oct 1-May 31)
Lone Pine Creek	RM 0	temperature (summer)
Meyer Creek	RM 0 – 5.3	temperature (summer), fecal coliform (year round)
Neil Creek	RM 0 – 11.4	temperature (year round), dissolved oxygen (year round)
Payne Creek	RM 0 – 2.1	temperature (summer), fecal coliform (year round), dissolved oxygen (year round)
Wagner Creek	RM 0 – 7.4	temperature (summer)
Walker Creek	RM 0 – 6.7	temperature (Oct 1- May 31)

Source: ODEQ 2003

Monitoring results showed the three Bear Creek sites exceeded the temperature standard into late September with the highest daily diurnal fluctuation of -12.8 °C (9 °F). The highest daily diurnal fluctuation in temperature on Bear Creek tributaries was -11.7 °C (11 °F) with the 17.8 °C (64 °F) criterion exceeded for extended time periods at all monitored sites. Some tributaries with two monitoring sites (Wagner and Coleman Creeks) had water temperature increases from the upper to lower sites and visa-versa (Griffin Creek) during some time periods. Jackson Creek showed very little change in temperature from the upper to lower site.

Climatic variables, air temperature, solar radiation, humidity, and the time of year have the greatest effect on Bear Creek water temperature. Tributary irrigation surface return flows may also have an effect on water temperature.

Ashland's wastewater treatment plant is the only major permitted point discharger directly into Bear Creek. This facility has been a major source of nutrient loading (about 80 percent of Bear Creek's nutrient loading) and warm water temperatures to Ashland Creek and Bear Creek (Reclamation 2001b). The city of Ashland completed an upgrade to its waste treatment facilities to bring nutrient discharges within ODEQ standards. Work on decreasing warm water discharges is pending (Ellis 2003).

Bacteria

About half of the 303(d) listed stream segments exceed standards for bacteria (fecal coliform). Bacteria sources in the highly developed Bear Creek watershed are likely attributable to cross connections between sanitary and storm sewer systems, certain permitted industrial sites, animal waste on ground surfaces (birds and livestock), illegal dumping into storm sewer systems, and general urban and rural runoff (ODEQ 2001). High bacteria levels impact beneficial uses associated with aesthetic quality and water-contact recreation.

Sediment

Agricultural water users on about 43 percent of the acreage have changed their water application methods from flood to sprinkler or drip irrigation over the last 25 years (Reclamation 2001b). These changes lowered the amount of irrigation surface runoff and subsurface return flow and sediment loading to Bear Creek.

Water Rights for Instream Flows

OWRD issued several certified instream flow water rights during 1996 to ODFW for Bear Creek tributaries including Emigrant, Walker, Wagner, and Griffin Creeks. ODFW also applied for monthly instream flow reservations for mainstem Bear Creek.

OWRD based the instream rights on estimated remaining unappropriated natural flow rather than on ODFW's originally petitioned seasonal flow which was based on biological fishery requirements derived from the Oregon Method.

Considerable debate took place as to whether Bear Creek ever naturally flowed at some of the monthly levels ODFW requested. OWRD (1966) estimated average natural (sometimes referred to as historic) flows at Bear Creek mouth, which provided a basis to compare current flows (see Table 4-8). OWRD subsequently proposed reduced instream flow based on prior water rights issued and the available amount of remaining unappropriated water. These rights are junior to previously issued consumptive rights and ODFW requested flows couldn't be met during the summer and fall periods because of senior irrigation diversion rights. OWRD never issued a final certification order for Bear Creek instream flow reservations. Table 4-9 lists final and proposed OWRD instream flow reservations for stream reaches in Bear Creek watershed.

Table 4-8. Natural and Current Water Flows in Bear Creek, and Instream Water Rights

	Estimated Natural (Historic) Flow	Current Flow Medford Gage[1]
January	216 cfs	221 cfs
February	265 cfs	223 cfs
March	241 cfs	202 cfs
April	182 cfs	197 cfs
May	168 cfs	134 cfs
June	101 cfs	73 cfs
July	40 cfs	29 cfs
August	24 cfs	29 cfs
September	20 cfs	31 cfs
October	24 cfs	33 cfs
November	62 cfs	59 cfs
December	153 cfs	147 cfs

[1]Average Monthly Discharge in cfs. Bear Creek at Medford (Mile 11.0). Period of record 1921-1981 Station 14357500.

Table 4-9. Bear Creek Watershed Instream Flow Rights (cfs)

OWRD-Issued Water Rights												
Stream	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May[1]	Jun	Jul	Aug	Sep
Emigrant Creek (downstream from dam)	6	13	27	38	48	46	37	38	22	9	6	5
Walker Creek (Cove Creek to mouth)	7	13	16	27	27	27	27	27 16	16	11	7	6
Wagner Creek (Basin Creek to mouth)	2	5	11	16	19	19	15	15	9	3	2	2
Griffin Creek (Hartley Creek to mouth)	0.5	2	7	10	13	11	7	5	3	1	0.5	0.4
OWRD Proposed Instream Flow Rights[2]												
Bear Creek (Walker Creek to mouth)	24	62	153	170	170	170	170	168 170	100	40	24	20

[1]Walker Creek and Bear Creek have split May instream flow. The top number applies to the first half of the month; the bottom number applies to the second half.

[2]An August 20,1996, draft OWRD certificate notice identified these instream flow rights. A final certificate was never issued.

4.2.2 Fish Passage

The Rogue Basin Fish Access Team (RBFAT) extensively surveyed the Rogue River basin to identify locations of juvenile and adult fish barriers. RBFAT is comprised of representatives from numerous State and Federal agencies and other groups that developed a plan and process to improve fish passage throughout the basin (RBFAT 2000). This plan includes description, classification and prioritization of barriers, a barrier removal prioritization process, treatment alternatives, project funding options, and other information.

RBFAT inventoried over 830 individual Rogue River basin fish barrier sites to date. These consist of pushup dams, concrete diversion dams, culverts, bridges, and other obstructions (Mason 2001). The inventory does not include irrigation pumping locations.

Little Butte Creek Watershed

The RBFAT inventory identified 60 fish barrier locations specific to the Little Butte Creek watershed. Fifty-nine of these were associated with privately owned facilities. These locations include 24 pushup dams that can require annual instream reconstruction; 12 permanent, mostly concrete-type, diversion dams; and 24 road culverts that impact fish passage. ODFW determined most of the diversion dams impede fish passage and many of the road culverts are absolute barriers under all flow conditions (RBFAT 2000). A large number of small streamside irrigation pumps of non-Project private water users are believed to be on streams and tributaries throughout the Little Butte Creek watershed. The RBFAT inventory excludes these pump withdrawal locations. The screening status of these locations is unknown.

The Little Butte Creek Watershed Council has been instrumental in securing landowner support and funding from Oregon Watershed Enhancement Board and USFWS to upgrade fish passage protection at several private diversion dams (Anthony 2001). These efforts have permanently removed several pushup dams and initiated other projects that will structurally correct adult and juvenile fish passage deficiencies. Knuteson (2001) provided technical design assistance on some of these projects (Hanley North, Hanley South, and Guill diversions). State of Oregon requires irrigation diversions to include installation of working fish screens. ODFW works cooperatively with landowners and administers a cost-share program whereby the diverter pays only 40 percent of the screening cost.

Federal Facilities

Antelope Creek Diversion Dam is a federally-owned facility operated by RRVID. Reclamation improved adult fish passage and fish screens at RRVID's Antelope Creek Diversion Dam in 1997 and 1998. The new fish screen system gives ODFW the ability to trap, collect, and haul downstream migrant smolts when streamflow is too low to provide adequate bypass flow back to Antelope Creek. RRVID operates and maintains the Reclamation-owned diversion facility.

Reclamation constructed six diversion dam structures in the head water tributaries of South Fork Little Butte Creek watershed. These structures are located upstream from a natural waterfall which blocks fish passage (USFS and BLM 1997). The facilities are South Fork Little Butte Creek Diversion Dam, Daley Creek Diversion Dam, Beaver Creek Diversion Dam, Dead Indian Diversion Dam, Pole Bridge Diversion Dam, and Conde Creek Diversion Dam. Reclamation constructed these facilities to collect water for conveyance across the Cascade Divide for storage in Howard Prairie

Lake. TID operates and maintains these diversion facilities. These diversion dams don't block fish passage and are not discussed further in the BA.

Non-Federal Facilities

MID and RRVID own, operate, and maintain North Fork and lower South Fork Little Butte Creek Diversion Dams. The diversion dams are each about one-half mile upstream from the confluence of the North Fork and South Fork Little Butte Creek.

A new fish screen was installed on the South Fork Little Butte Creek in April 2003. The fish ladder, also at this site, is scheduled to be replaced summer 2003 during low flows.

The fish screen and ladder for the North Fork Little Butte Creek do not meet present day standards. Grant money was awarded for 2003, construction is scheduled to begin in fall 2003.

RRVID and MID canals traverse some anadromous fish-bearing streams in the Little Butte Creek watershed. However, all such crossings use flume or siphon structures and pose no fish passage impediments. No water is withdrawn from these streams, except at Antelope Creek Diversion Dam, to augment canal flow. Table 4-10 provides information on these canal crossings relative to fish passage.

Other private diversion dam structures exist in South Fork Little Butte Creek watershed. Many fish screen facilities still do not meet present day fish protection design standards. The ODFW inventory in the Little Butte Creek watershed indicates 16 operating fish screen installations meet current fish passage protection criteria while 18 are inadequate (Kilbane 2001).

Bear Creek Watershed

RBFAT identified a large number of physical fish passage barriers located throughout the Bear Creek watershed. The RBFAT program prioritizes fish passage funding and improvement projects. Table 4-11 provides a general tally of fish passage barriers identified to date. The RBFAT (2000) inventory lists 119 fish passage barriers in tributaries entering Bear Creek downstream from Emigrant Dam. Road culverts and bridge crossings comprise 108 of these. ODFW judged most of these to be either total fish passage barriers under all flow conditions or to be a passage impediment under most flows. The remaining 11 barriers are mostly non-Federal permanent concrete diversion structures.

Table 4-10. Rogue River Basin Project Canal Crossings of Anadromous Fish-Bearing Streams in Little Butte Creek Watershed

Creek Crossed (Fish Species)	Canal Mile	Type of Crossing	Wasteway at Crossing?	Possible Creek Diversions to Canal?	Is Fish Passage Protection Provided at Diversion?
Creeks crossed by RRVID's Hopkins Canal (diversion from Joint System Canal at Bradshaw Drop, canal mile 17.0)					
Yankee Creek (steelhead)	2.70	flume	no	no	RRVID does not divert water from Yankee Creek.
Antelope Creek (steelhead, coho salmon)	3.40	siphon	yes	yes	RRVID's Antelope Creek Diversion Dam is screened and laddered; Antelope Creek has no other RRVID diversions.
Creeks crossed by MID's Joint System Canal and used by RRVID (diversions from North Fork Little Butte Creek at RM 0.8 and South Fork Little Butte Creek at RM 17.9)[1]					
Lake Creek (steelhead, coho salmon)	1.47	siphon	no	no	MID has no diversions from Lake Creek.
Creeks crossed by MID's Medford Canal (diversion from Joint System Canal at Bradshaw Drop, canal mile 17.0)[1]					
Yankee Creek (steelhead)	3.06	siphon	yes	no	MID has no diversions from Yankee Creek.
Antelope Creek (steelhead, coho salmon)	4.90	siphon	yes	no	MID has no diversions from Antelope Creek

[1] Private facilities which are not part of the proposed action

The RBFAT list excludes streamside pump locations that have the potential to dewater the stream and entrain juvenile salmonids if not properly screened. Existing screen systems on pump intakes and gravity surface diversions in fish-bearing streams often don't meet current fish passage protection criteria or may not exist. The inventory is not necessarily complete and does not include all the fish passage barrier locations (categories listed above) on Bear Creek tributaries (Ritchey 2001).

Table 4-11. RBFAT-Inventoried Bear Creek Fish Passage Barriers Downstream from Emigrant Dam

Barrier Type	Mainstem Bear Creek	Bear Creek Tributaries
Diversion dams: Project permanent structures (Oak Street, Phoenix, and Jackson Street)	3 (all meet current NMFS passage criteria)	10 (6 meet current NMFS passage criteria)
Pushup dams	none	1 (does not meet current NMFS passage criteria)
Road culverts/bridges	none	108
Streamside pumps	not documented	not documented
Total RBFAT barriers	3	119

Source: RBFAT 2000

Sixteen tributaries considered to be fish-bearing streams for salmon and steelhead enter Bear Creek. These streams, plus a few of their respective smaller tributaries, are documented locations for anadromous fish migration, spawning, and rearing (Figure 4-1). Fish passage impediments related to road and highway crossings, urban and rural land uses, and water withdrawal systems are found within all these streams.

Many undocumented locations likely exist where water is diverted from the 16 tributaries into ditches or through pump intakes. Fish passage protection at these locations may be lacking or many diversions could be upstream from fish migration blockages in lower reaches of the stream. Water users divert from these streams and share in fish passage problems.

Federal Facilities

Emigrant Dam, 29 miles upstream from the mouth of Bear Creek on Emigrant Creek, was first built in 1924 and enlarged as part of the authorized Project in 1960. The dam has no fish passage facilities.

Two Federal diversion dams are on mainstem Bear Creek downstream from Emigrant Dam. Oak Street Diversion Dam (RM 21.6) and Phoenix Canal Diversion Dam (RM 16.8). Reclamation and irrigation districts were involved in funding, designing, and making extensive modifications to these diversions and their fish passage facilities from 1997 to 1999 under the Rogue River Basin Fish Passage Improvement Program. This work upgraded fish passage protection at the diversions to the latest NMFS criteria for fish ladders, fish screens, and juvenile bypass systems.

New adult fish ladders were constructed at the dams and older fish screens in the canal were replaced with state-of-the-art rotary drum or self-cleaning vertical screens. Juvenile fish bypass systems were also included in the modifications. Adult fish passage has improved since the fish passage modifications were made at these structures (Ritchey 2001). More fall Chinook salmon spawners were noted in Bear Creek upstream from Oak Street Diversion Dam in the fall of 2000 than in any of the previous six years that redd counts were conducted in Bear Creek (Hutchins 2001).

Some canal crossings on Bear Creek tributaries may impede or block upstream migration. However, most canal crossings are now by buried siphon or overhead flume.

Non-Federal Facilities

Jackson Street Diversion Dam (RM 9.6) is a non-Federal diversion dam on Bear Creek downstream from Emigrant Dam. Hopkins Canal Diversion Dam was dismantled and completely replaced one-quarter mile upstream by Jackson Street Diversion Dam. Reclamation and irrigation districts were involved in funding, designing, and making extensive modifications to the diversion dam and its fish passage facilities from 1997 to 1999 under the Rogue River Basin Fish Passage Improvement Program. This work upgraded fish passage protection at the diversion to the latest NMFS criteria for fish ladders, fish screens, and juvenile bypass systems.

New adult fish ladders were constructed and older fish screens in the canal were replaced with state-of-the-art rotary drum or self-cleaning vertical screens. Juvenile fish bypass systems were also included in the modifications. Adult fish passage in Bear Creek has improved since the fish passage modifications were made (Ritchey 2001).

Medford and Phoenix Canals cross fish-bearing streams by using concrete dam structures with check boards that can be removed after the irrigation season. Some of the crossings can spill canal water to the natural stream course for conveyance to downslope water users. Creeks where irrigation districts retain natural flow rights can be diverted to the canal. Table 4-12, Table 4-13, and Table 4-14 provide the type of crossing, creek diversions to the canal, existing fish passage protection, and diversions from the canal (wasteway) for TID, MID, and RRVID canal crossings on fish-bearing Bear Creek tributaries.

Table 4-12. TID Canal Crossings and Diversions from Anadromous Fish-Bearing Streams in Bear Creek Watershed

Creek Crossed (Fish Species)	Canal Mile	Type of Crossing	Wasteway at Crossing?	Possible Creek Diversions to Canal?	Fish Passage Protection Provided at Stream Diversions?
Ashland Canal - Diversion From Emigrant Creek at Ashland Canal Diversion Dam (RM 33.7)					
Neil Creek (steelhead, coho salmon)	9.78	siphon	yes	yes	TID's canal diversion is screened and will be laddered in 2004; no other TID diversions at Neil Creek
Clayton Creek (steelhead)	11.0	siphon	yes	no	No TID diversion on Clayton Creek
Tolman Creek (steelhead, coho salmon)	13.68	siphon	yes	no	1 TID diversion on Tolman Creek without fish passage protection
Hamilton Creek (steelhead, coho salmon)	13.95	siphon	No	no	2 TID diversions on Hamilton Creek without fish passage protection
East Canal - Diversion From Emigrant Lake Outlet Channel (RM 29.2)					
Cove and Walker Creeks (steelhead)	4.06	siphon	No	no	No TID diversion on Cove and Walker Creeks
Gaerky Creek (steelhead)	7.06	siphon	yes	no	No TID diversion on Gaerky Creek
Kitchen Creek (steelhead)	8.20	siphon	yes	no	No TID diversion on Kitchen Creek
	11.85	Diversion to West Canal and Billings Wasteway to Bear Creek (3,200 feet of 18-inch pipe)			
Butler Creek (steelhead)	12.81	siphon	yes	no	1 TID diversion on Butler Creek without fish passage protection
Meyer Creek (steelhead)	13.72	siphon	yes	no	3 TID diversions on Meyer Creek without fish passage protection
Kentuchen Creek (steelhead)	18.08	siphon	yes	no	No TID diversion on Kentuchen Creek
Larson Creek (steelhead)	24.65	siphon	yes	no	1 TID diversion on Larson Creek below canal crossing

Creek Crossed (Fish Species)	Canal Mile	Type of Crossing	Wasteway at Crossing?	Possible Creek Diversions to Canal?	Fish Passage Protection Provided at Stream Diversions?
West Canal – Diversion From East Canal (Canal Mile 11.85)					
Lower Wagner Creek (steelhead) [1]	4.90	siphon	yes	yes	Creek diversion to West Canal is fitted with fish ladder and screen.
Coleman Creek (steelhead)	10.23	siphon	yes	no	1 TID diversion downstream from West Canal siphon crossing of Coleman Creek. Without fish passage protection.
Griffin Creek (steelhead)	17.95	siphon	yes	no	1 TID diversion from Griffin Creek. Without fish passage protection.
Talent Canal –Diversion From Bear Creek at Oak Street Diversion Dam (RM 21.6)					
Butler Creek (steelhead)	1.99	siphon	yes	no	No TID diversion from Butler Creek
Bear Creek (steelhead, coho salmon, fall Chinook salmon)	2.63	siphon	No	no	Buried Talent Canal siphon under Bear Creek does not impede fish passage
Coleman Creek (steelhead)	9.92	siphon	yes	no	2 TID diversions on Coleman Creek without fish passage protection
Griffin Creek (steelhead)	18.99	siphon	yes	yes	No diversion from Griffin Creek downstream from canal crossing.
	22.37	End of lateral. Excess flow enters natural drainage to Phoenix Canal.			

Table 4-13. MID Canal Crossings and Diversions from Anadromous Fish-Bearing Streams in Bear Creek Watershed

Creek Crossed (Fish Species)	Canal Mile	Type of Crossing	Wasteway at Crossing?	Possible Creek Diversions to Canal?	Fish Passage Protection Provided at Stream Diversions?
Medford Canal - Diversion from Joint System Canal at Bradshaw Drop (Canal Mile 17.0)[1]					
Lazy Creek (steelhead)	23.14	diversion check dam across creek	yes	yes	Upstream and downstream fish passage is blocked when the dam's check boards are in place. No other downstream MID diversions exist from Lazy Creek.
Larson Creek (steelhead)	25.17	diversion check dam across creek	yes	yes	Upstream and downstream fish passage is blocked when the dam's check boards are in place. No other downstream MID diversions exist from Larson Creek.
Bear Creek (coho salmon, steelhead, fall Chinook salmon)	29.4	siphon	yes	End of Medford Canal siphon discharges into Phoenix Canal	
Phoenix Canal – Diversion From Bear Creek at Phoenix Canal Diversion Dam (RM 16.8)					
Bear Creek (coho salmon, steelhead, fall Chinook salmon)	NA	Phoenix Canal Diversion Dam is laddered and screened.			
Coleman Creek (steelhead)	3.09	diversion check dam across creek	yes	yes	Upstream and downstream fish passage is blocked when the dam's check boards are in place. No other downstream MID diversions exist from Coleman Creek
Griffin Creek (steelhead)	9.15	diversion check dam across creek	yes	yes	Upstream and downstream fish passage is blocked when the dam's check boards are in place. 2 downstream MID diversions on Griffin Creek without fish passage protection.
Jackson Creek (steelhead)	12.23	siphon	yes	no	

[1] Private facility which is not part of proposed action

Table 4-14. RRVID Canal Crossings and Diversions from Anadromous Fish-Bearing Streams in Bear Creek Watershed

Creek Crossed (Fish Species)	Canal Mile	Type of Crossing	Wasteway at Crossing?	Possible Creek Diversions to Canal?	Fish Passage Protection Provided at Stream Diversions?
Hopkins Canal - Diversions From Bear Creek at Jackson Street Diversion Dam (RM 9.5)					
Bear Creek (coho salmon, steelhead, fall Chinook salmon)	NA	siphon	yes	yes	Jackson Street Diversion Dam is laddered and screened
Griffin Creek (steelhead)	3.65	flume	yes	yes, but diversion is no longer used	1 RRVID diversion on Griffin Creek downstream from canal crossing without fish passage protection
Jackson Creek (steelhead)	4.10	flume	yes	yes, possible by pump but diversion is no longer used	2 RRVID diversions from Jackson Creek downstream from flume without fish passage protection
Dean Creek (steelhead)	7.66	flume	yes	no	1 RRVID diversion on Dean Creek without fish passage protection
Willow Creek (steelhead)	8.17	End of lateral. Water spills to Willow Creek for delivery to downstream water users. No RRVID diversion facilities are on Willow Creek.			

A private dam located about one-half mile downstream from Emigrant Dam on Emigrant Creek is a blockage to upstream salmon migration. However, coho salmon probably do not spawn in this reach (Ritchey 2001).

Mainstem Bear Creek may have a number of small private, pump diversions along the stream. It is unknown whether the pump intakes are screened. Other fish passage barriers include road culverts and bridge crossings, and an undocumented number of small irrigation water diversion structures or pumps on Bear Creek tributaries.

A fish screening cost-share program with the State of Oregon is available to those with water rights issued prior to 1989 (Kilbane 2001). Rogue Valley Council of Governments staff walked the lengths of Bear Creek tributaries a few years ago identifying water withdrawal locations by using GPS and digital camera equipment. Data and results from this inventory, however, have yet to be compiled and reported.

4.2.3 Klamath River Basin

All actions described as part of the environmental baseline have led to the current status of coho salmon in the Klamath River basin. Coho salmon are restricted to the mainstem Klamath River and tributaries below Iron Gate Dam. No passage facilities exist at Iron Gate or Copco dams, which are owned and operated by PacifiCorp. Available recent information suggests adult populations are small to nonexistent in some years. Existing information also indicates that adult coho salmon are present in the Klamath River as early as September and juvenile coho salmon are present in the mainstem Klamath River year round.

The Klamath River basin coho salmon discussion is taken from Reclamation's 2002 Klamath Project BA (Reclamation 2002).

The historic range of coho salmon in the Klamath River basin is illustrated in Figure 4-4. Historic salmon habitat in the Upper Klamath River basin was blocked as early as 1889 at Klamathon near Iron Gate (KRBFTF 1991). Beginning in 1910, the Federal Bureau of Fisheries installed a fish rack to capture salmon eggs, leaving little chance for passage of upstream migrants after that time. In 1917, the construction of Copco Dam formed a complete block to upstream migration and the loss of over 75 miles of habitat in the Klamath River plus tributaries as far upstream as above Upper Klamath Lake.

Mining activities within the Klamath basin began before 1900 (KRBFTF 1991). Water was diverted and pumped for use in sluicing and hydraulic mining operations. This resulted in dramatic increases in silt levels altering stream morphology and degrading spawning and rearing areas. The mining activities may have had a greater negative impact to the salmon fishery than the large fish canneries of the era. Since the 1970s, mining operations have been curtailed due to stricter environmental regulations. However, mining operations in some of the Klamath River tributaries continue, including suction dredging, placer mining, gravel mining, and lode mining. These operations can adversely affect spawning gravels, decrease survival of eggs and juvenile fish, decrease the abundance of bottom food organisms, adversely affect water quality, and impact stream banks and channels.

Roads associated with timber harvesting and timber management activities have contributed to erosion and increases in sedimentation in streams causing degradation of spawning gravels, pool filling, reduced aquatic insect abundance, and changes in channel structure and habitat diversity.

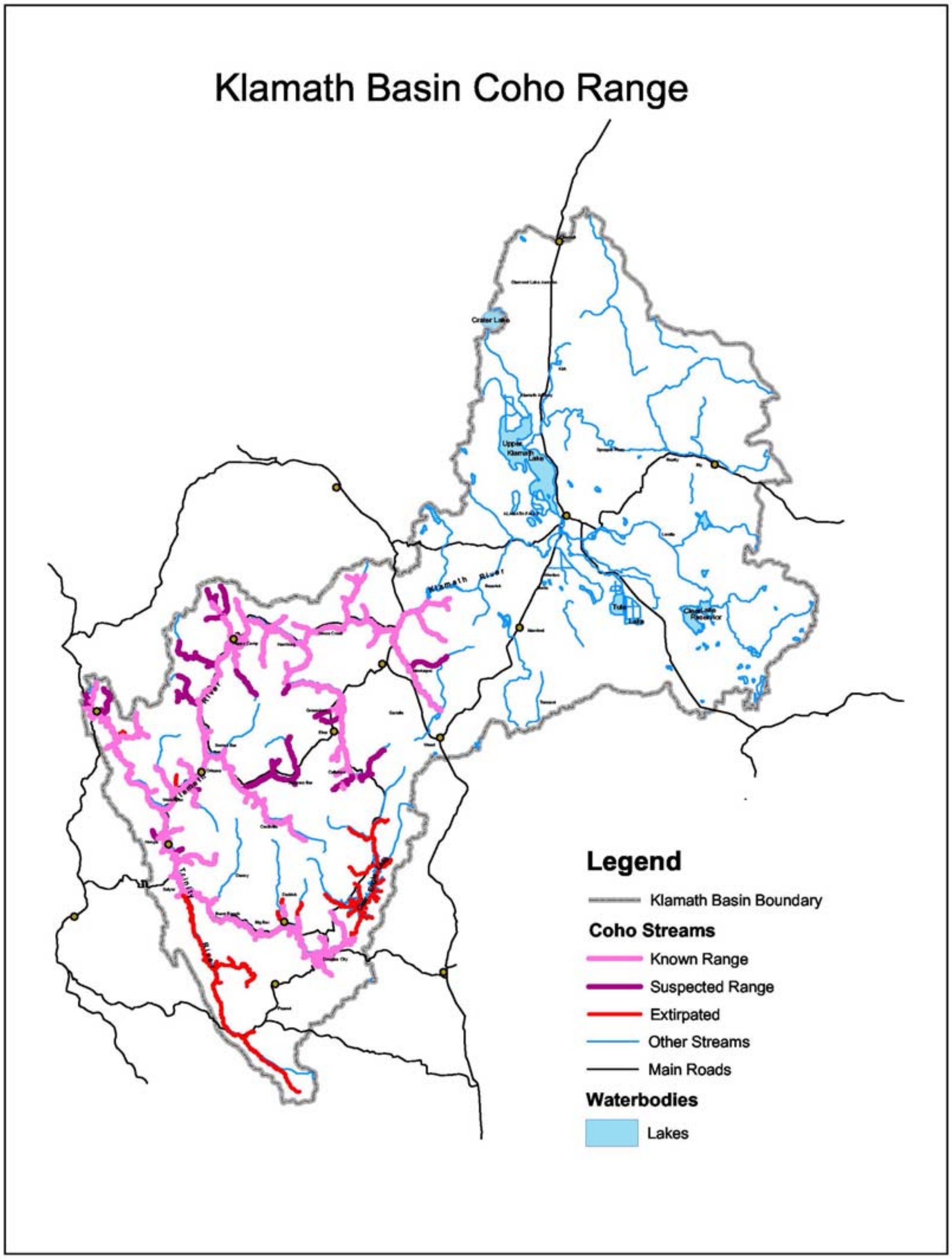

Figure 4-4. Historical range of coho salmon in the Klamath River Basin. Source: Reichert 2003.

Klamath River Mainstem

Beginning in the late 1800s, construction and operation of the numerous non-Project facilities and, beginning in 1906, Klamath Project facilities have changed the natural hydrographs of the mainstem Klamath River (Reclamation 2001c). Major Project diversion facilities include the A-Canal, Link River Dam, Lost River Diversion Dam, and the Lost River Diversion Channel. Non-Project facilities include Copco Nos. 1 and 2 Dams, J.C. Boyle Hydroelectric Dam, Iron Gate Dam and Keno Dam. Changes in the flow regime at Keno, Oregon, after the construction of the A-Canal, Link River Dam, and the Lost River Diversion Dam, can be seen in the 1930-to-present flow records. These changes have reduced average flows in summer months and altered the natural seasonal variation of flows to meet peak power and diversion demands (Hecht and Kamman 1996). Flows downstream from Iron Gate Dam affect the quantity and quality of aquatic habitat for coho salmon in the mainstem Klamath River in California.

Iron Gate Dam, located approximately at RM 190 on the mainstem Klamath River, was completed in 1962 and is owned and operated by PacifiCorp. Iron Gate Dam was constructed to re-regulate flow releases from the Copco facilities, but it did not restore the preproject hydrograph. Minimum stream flows and ramping rate regimes were established in the FERC license covering operation of Iron Gate Dam. A fish hatchery was constructed by PacifiCorp as a mitigation measure for the loss of fish habitat between Iron Gate and Copco No. 2 Dams.

Klamath River Tributaries

Klamath River tributaries downstream from Iron Gate Dam provide habitat critical for coho salmon. Jenny Creek is located upstream of Iron Gate Dam and is not accessible to coho salmon. Most coho spawning occurs in the tributary streams rather than in the mainstem of Klamath River. The mainstem serves primarily as a migratory pathway. Coho move into the tributaries with the onset of fall rains and increased flows. Suitable tributary flows are important to provide coho access to spawning habitat during their upstream migrations. Many coho attempt to migrate as far upstream as possible and then hold in deep pools near good spawning sites until they are ready to spawn a month or more after freshwater entry. Redds (spawning sites) must remain watered throughout the incubation period. After they emerge from the gravel in the spring the young fish disperse into the available habitat. During the year that juvenile coho spend in freshwater they utilize pools with good cover and cool water, which are predominantly in the tributaries. Cool water is critical for survival during the warm summer period. Many coho likely move downstream from the spawning location because coho generally spawn near the upstream extent of good rearing habitat. It is unlikely that significant numbers of coho enter the mainstem Klamath for summer rearing because tributary water temperatures are cooler. During winter when water temperature is below about 10 °C (50 °F) and high flows are more frequent, juvenile coho seek denser cover and lower water velocity than used during the summer. These conditions are often found in off-channel areas of the tributaries.

Outside of the Klamath Project, many Klamath River tributaries have been modified significantly, which affected coho populations. The natural hydrograph has been modified by water diversions in major tributaries such as the Shasta River, Scott River, Trinity River, Cottonwood Creek, and Bogus Creek. Many of the steeper watersheds have experienced substantial road building and timber harvest. Mining occurred historically and continues within active channels mostly in the form of small one or two person operations using portable dredges in areas such as the Scott River.

Agricultural diversions from major Klamath tributaries downstream of the project have resulted in summer flow conditions that eliminate a significant amount of juvenile rearing habitat. Agricultural diversions typically start during the spring and continue into the fall. During most years, spring flows are sufficient to maintain fish habitat and support the diversions. Coho generally rear near the area that they were spawned. When diversions begin in the spring of dry years, stream flow drops substantially and can strand fry or outmigrating smolts. As the summer progresses, and natural flows decrease, the diversions take a majority of the net flow. The coho downstream of diversions get forced into smaller habitat areas, water temperature increases with the lower water volume, and predation by other fish and terrestrial predators increases. The result is a much lowered survival of juvenile coho through the summer and fall period. While many diversions have been screened in recent years, there remain many unscreened diversions. Some coho rearing near the diversion points get diverted into agricultural fields or may get drawn into pumps and killed. During many years, the flows required to maintain fishery values and support heavy agricultural diversions simply are not in the system during the latter part of July, August, and September. Many streams would have critically low flow levels during this time even if no water were diverted.

During the fall when adult coho salmon begin their upstream migrations, flows from the tributaries are critical for providing access to the spawning areas in the tributaries. During dry years, such as occurred in 2001, flows in tributaries can be too low for adults to enter the rivers. They are then forced to hold in the mainstem Klamath River until flows increase enough to allow for upstream migration. Some tributaries contain difficult passage areas where low flows cause partial or total barriers to upstream migration. If coho are held back by low flows until ready to spawn they can spawn in areas lower in the watershed, but the amount of habitat available to the juveniles is then restricted to the lower reaches of the rivers. Diversion dams exist in some tributaries and impede upstream access by juveniles and adults.

Water Quality

In addition to hydrologic changes caused by the activities discussed above, human activities have resulted in degraded water quality in the Klamath River basin. The main water quality problem for coho is high water temperature. The Klamath River, from source to mouth, is listed as water quality impaired (by both Oregon and California) under Section 303(d) of the Federal Clean Water Act (CWA). In 1992, the California State Water Resources Control Board proposed that the Klamath River be listed under the CWA as impaired for both temperature and nutrients, requiring the development of TMDL limits and implementation plans. The EPA and the North Coast Regional Water Quality Control Board accepted this action in 1993. The basis for listing the Klamath River as impaired was aquatic habitat degradation due to excessively warm summer water temperatures and algae blooms associated with high nutrient loads, water impoundments, and agricultural water diversions (EPA 1993). However, the Klamath River has probably always been a relatively warm river (Hecht and Kamman 1996).

Tributary influences to the Klamath River mainstem temperatures are seasonally important (Deas and Orlob 1999). During the spring, certain tributaries contribute significant inflow to the mainstem. By mid- to late spring, the tributary flow drops in response to irrigation demand, and tributary contributions to the mainstem are minor. In the summer and early fall, tributary flows are small relative to the mainstem flow. Locally, these tributaries may have an impact, but generally, they provide minor contribution to the water temperature of the system (Deas and Orlob 1999). Generally tributary water is cooler than the mainstem, and the tributary flows are much lower than the mainstem such that the higher mainstem flows mask the temperature benefits from the tributaries. The termination of irrigation in late fall results in increased inflow from major tributaries. These tributaries have small thermal mass relative to the Klamath River (and Iron Gate Reservoir), and thus cool quickly as the weather cools, providing thermal relief to the mainstem.

Dissolved oxygen sometimes falls to harmful levels below Iron Gate Dam at night during warm periods of the summer. This is caused by the high nutrient load from upstream sources causing increased algal growth in the warm water. The generally well-oxygenated tributary inflows can provide water quality refuge areas for coho salmon as they enter the mainstem Klamath River.

The combined effects of high temperatures, high nutrient concentrations, and low dissolved oxygen levels during the summer months can create extremely stressful conditions for coho salmon and other salmonids in the Lower Klamath River. High nutrient concentrations and associated increase in the abundance of algae and aquatic plants tend to lead to increased sedimentation and water temperatures, slower velocities, and lower dissolved oxygen. In June of 2000, temperatures and dissolved oxygen levels reached critical levels in the Klamath River and resulted in a large fish kill of juvenile salmonids (CDFG 2000a). No major fish kills were reported in the mainstem Klamath River during summer 2001. A major fish kill of adult salmonids occurred in the lower 36 miles of mainstem Klamath River during September, 2002. A minimum of 33,000 adult salmon died (CDFG 2003). Of the dead fish collected by CDFG downstream of the mouth of Blue Creek on September 27, 2002, 95.2 percent were fall Chinook salmon and 0.5 percent were coho salmon (CDFG 2003).

High nutrient concentrations in the Klamath River in large part come from the Upper Klamath basin where anthropogenic sources contribute significantly. Widespread grazing, agriculture, logging and conversion of wetland to agricultural land have increased nutrient loading. Most lakes in the Upper Klamath basin are shallow and water temperatures closely track air temperatures. Thus, flows originating from the headwater areas are naturally warm during the summer.

Fish Harvest

Commercial fishing for salmon in the Klamath River had major impacts on populations as early as 1900. Commercial and recreational ocean troll fisheries, tribal subsistence fisheries, and in-river recreational fisheries have impacted salmon including coho throughout the 20th Century. Over-fishing was considered one of the greatest threats facing the Klamath River coho salmon populations in the past. However, these harvest rates probably would not have been as serious if spawning and rearing habitat was not so extensively reduced and degraded. Sport and commercial fishing restrictions ranging from severe curtailment to complete closure in recent years may be providing an increase in adult coho survival. The tribal harvest in the Klamath has been relatively small in the last five years and likely has not had a measurable effect on coho populations (NMFS 2001).

Hatchery Programs

The Klamath and Trinity Basin coho salmon runs are now composed largely of hatchery fish, although there may still be wild fish remaining in some tributaries. Because of the predominance of hatchery stocks in the Klamath River basin, stock transfers (use of spawn from coho salmon outside the Klamath River basin) in the

Trinity and Iron Gate Hatcheries may have had a substantial impact on natural populations in the basin. Artificial propagation can substantially affect the genetic integrity of natural salmon populations in several ways. First, stock transfers that result in interbreeding of hatchery and natural fish can lead to loss of fitness (survivability) in local populations and loss of diversity among populations (Weitkamp et al. 1995). Second, the hatchery salmon may change the mortality profile of the populations, leading to genetic change relative to wild populations that is not beneficial to the naturally reproducing fish. Third, hatchery fish may interfere with natural spawning and production by competing with natural fish for territory or mates. The presence of large numbers of hatchery juveniles or adults may also alter the selective regime faced by natural fish.

Coho Salmon Abundance in Klamath River Basin

Limited information exists regarding present coho salmon abundance in the Klamath River basin. Adult counts in a few Klamath River tributaries and juvenile trapping on the Klamath River mainstem and tributaries provide valuable information on presence of coho salmon in specific areas during key time periods, but less valuable for determining population status or trends (NMFS 2001). However, they do provide some indication of low abundance and the status of coho salmon populations in the Klamath River basin.

Adult Data

During the period 1991 and 2000, adult coho salmon counts using weir and video observations in the Shasta River ranged from 0 to 24 fish, with 1 or 0 fish counted during four of these years. Counting weirs in the Scott River indicated an average of 4 fish (range 0-24) during the period 1991 and 2000. One of those years accounted for approximately 65 percent of the total number of coho observed and zero coho were observed in four years. Coho salmon were observed in the Scott River during this period as early as September 21. In Bogus Creek, an average of 4 coho adults (range 0-10) were counted at the weir. These data emphasize the importance that one year’s spawning success can have on the survival of these coho salmon stocks.

Coho salmon counts in the Trinity River are mostly of hatchery origin, and 100 percent marking of hatchery coho salmon has only recently occurred so estimates of naturally-produced coho are only available since the 1997 return year. The results of counting for the 1997-1998, 1998-1999, and 1999-2000 seasons yielded an estimated 198, 1,001, and 491 naturally produced adult coho salmon, respectively (CDFG 2000b). Coho salmon were first observed at the Trinity River weir during the week of September 10 during the 1999-2000 trapping season (CDFG 2000b).

Juvenile Data

Recent smolt data suggests that Klamath Basin coho salmon recruitment is very low. Juvenile traps, operated by USFWS on the Klamath River mainstem at Big Bar (RM 48), were used to estimate indices of smolt production. Based on counts from these traps between 1991 and 2000, the annual average number of wild coho salmon smolts was estimated at only 548 individuals (range 137-1,268)(USFWS 2000b). For the same period, an average output of 2,975 wild coho salmon smolts (range 565-5,084) was estimated for the Trinity River at Willow Creek, within the Trinity sub-basin (USFWS 2000b). The incomplete trapping record provides limited information in terms of temporal trends, but it still is a useful indicator of the extremely small size of coho salmon populations in the Klamath Basin.

The USFWS operates downstream juvenile migrant traps on the mainstem Klamath River at Big Bar (RM 48). The incomplete trapping record provides limited information in terms of abundance or trends, but does indicate the presence of coho at different life stages during certain times of the year (NMFS 2001). Indices of abundance are calculated from actual numbers trapped. In 2001, coho salmon smolts from trapping at Big Bar resulted in an actual total count of 23 fish between April 9 and July 22; 14 which were considered wild (USFWS 2001b). Trapping was discontinued after July 22 because of heavy algal loading in the traps.

A 1997 FWS report and 2001 mainstem trap data (CDFG unpublished data) show that young-of-the-year coho salmon are emerging from the Shasta and Scott rivers, where they probably were spawned, into the mainstem of the lower Klamath River between March and August. Considering the low numbers of coho salmon fry that have been reported from these sub-basins, it is unlikely that these fish were displaced downstream because of competitive interactions with other juveniles of their own species. Instead, the most likely explanation for their summer movement is that declining water quality and quantity in the lower-order tributaries force these young fish to seek refuge elsewhere. Thus, they end up in the river's mainstem earlier than in other river systems. This exploratory behavior and movement in search for adequate nursery habitat has been well documented, especially before the onset of winter (Sandercock 1991).

Stream Habitat Conditions

Anadromous salmonids in the Klamath River are restricted to the mainstem Klamath River and tributaries below Iron Gate Dam. Jenny Creek is located upstream of Iron Gate Dam and is not accessible to coho salmon. No passage facilities exist at Iron Gate or Copco dams, which are owned and operated by PacifiCorp.

Coho salmon still occur in the Klamath River and its tributaries (CH2M Hill 1985; Hassler et al. 1991). Between Seiad Valley and IGD, coho salmon populations are believed to occur in Bogus Creek, Shasta River, Humbug Creek, Empire Creek, Beaver Creek, Horse Creek, and Scott River (NMFS 1999). Between Orleans and Seiad Valley, coho salmon populations are believed to occur in Seiad Creek, Grider Creek, Thompson Creek, Indian Creek, Elk Creek, Clear Creek, Dillon Creek (suspected), and Salmon River (NMFS 1999). Finally, between Orleans and Klamath (mouth of the river), coho salmon populations are believed to occur in Camp Creek, Red Cap Creek, Trinity River, Turwar Creek, Blue Creek, Tectah Creek, and Pine Creek (NMFS 1999). It is estimated that Shasta River presently maintains approximately 38 miles of coho habitat, which is below predevelopment levels (INSE 1999). Available data suggests that existing coho salmon habitat in the Scott River now constitutes approximately 88 miles (INSE 1999).

Unscreened or ineffectively screened diversions are common in the Shasta and Scott Rivers resulting in substantial entrainment and fish stranding. Downstream migrants are also trapped in pools or side channels when stream flows drop sharply during early summer and soon die from high temperatures, lack of food, or predation. Some portions of streams often become entirely dewatered due to diversion. To date, CDFG has screened 30 diversions throughout the Scott River. Coho salmon juveniles are very susceptible to diversions because they need to spend at least one full summer in the stream.

4.3 Lost River and Shortnose Suckers

A great deal of environmental baseline information exists on the Lost River and shortnose suckers in the Klamath River basin. Portions of the information contained in this section were taken from the 2002 Biological Opinion on the 10-year (June 1, 2002, through March 31, 2012) Operation Plan for the Klamath Project, USFWS BO 1-10-02-F-121 (USFWS 2002). This information is included by reference into this BA.

Early records indicate Lost River and shortnose suckers were widespread and abundant within their range. The Klamath and Modoc Indians Spring relied on sucker runs at the beginning of the 20th century as a food source, and local settlers used them for both human consumption and livestock feed. Sucker runs were so numerous a cannery was established on the Lost River and several commercial operations processed enormous amounts of suckers into oil, dried fish, and other products (Andreasen 1975). A popular snag fishery existed on Sprague and Williamson Rivers during the 1960s and 1970s. Sucker populations likely numbered in the millions.

Nearly all Klamath basin streams and rivers have been degraded, some seriously, by the loss of riparian vegetation, geomorphic changes, introduction of return flows from agricultural drainage ditches and water pumped from drained wetlands, stream channelization, dams, and flow reductions from agricultural and hydroelectric diversions. Several water bodies in the Klamath basin fail to meet state water quality criteria. Wetland losses have been especially significant for suckers since wetlands provide habitat for larval and juvenile suckers and provide beneficial water quality functions.

The factors contributing to the decline of the suckers include habitat loss, degradation, and fragmentation; small or isolated adult populations (reproduction); isolation of existing populations by dams (passage); poor water quality leading to large fish die-offs and reduced fitness; lack of sufficient recruitment; entrainment into irrigation and hydropower irrigation canals; hybridization with other native Klamath sucker species; potential competition with and predation by non-native fishes; and overharvesting by sport and commercial fisheries.

Historically, both Lost River sucker and shortnose sucker occurred throughout the Upper Klamath basin, with the exception of the higher, cooler tributaries dominated by resident trout and the upper Williamson, which is isolated by the Williamson Canyon. At the time of listing, Lost River sucker and shortnose sucker were reported from Upper Klamath Lake, its tributaries, Lost River, Clear Lake Reservoir, the Klamath River, and the three larger Klamath River reservoirs (Copco, Iron Gate, and J.C. Boyle). The general range of Lost River sucker and shortnose sucker had been substantially reduced from its historic extent by the total loss of major populations in Lower Klamath Lake, including Sheepy Lake and Tule Lake (Federal Register 53:27130).

The current geographic ranges of the Lost River sucker and shortnose sucker have not changed substantially since they were listed and only two additional shortnose sucker and one Lost River sucker populations have been recognized since 1988. They all occur in isolated sections of the Lost River drainage, within the historical ranges of the species, and include an isolated population of shortnose sucker in Gerber Reservoir and a small population (limited to several hundred adults) of each species in Tule Lake.

The Klamath River reservoir population receives individuals carried downstream from upper reaches of the river, but they are isolated from the Upper Klamath basin by dams and show no evidence of self-sustaining reproduction (Desjardins and Markle 2000). (USFWS 2002)

4.3.1 Iron Gate Reservoir

Suckers may spawn successfully in tributaries to Iron Gate Reservoir as documented by the presence of sucker larvae in 1998 and 1999. However, because the species of sucker larvae can't be identified, it is not known which sucker species was successful. Sucker spawning may also occur in the Klamath River downstream from Copco 2 Reservoir in Iron Gate Reservoir.

Few or no sucker larvae survive in Iron Gate Reservoir either because adult populations are too small, producing too few larvae to survive normal early mortality rates, or because habitat conditions are unfavorable (Desjardins and Markle 2000).

Fish surveys were conducted in Iron Gate Reservoir from 1997 to 1999 (Desjardins and Markle 2000). A total of 22 adult shortnose suckers and 22 Klamath smallscale suckers (*Catostomus rimiculus*) were collected. Larger and older individuals dominated with little variation in size structure of those fish collected. Additionally, 42 and 1,135 unidentified sucker larvae were collected in 1998 and 1999, respectively. Larvae were small and only captured during early summer. No juvenile suckers and no Lost River suckers were collected during these surveys.

Predation pressure may be high in Iron Gate Reservoir because its fish community is dominated by exotic predators including yellow perch (*Perca flavescens*), brown bullheads (*Ameiurus nebulosus*), largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), and green sunfish (*Lepomis cyanellus*). The percent of exotic predators in 1999 was 77 percent in Iron Gate Reservoir compared to 37 percent in J.C. Boyle Reservoir, and 66 percent in Copco Reservoir.

Water Quality in Iron Gate Reservoir

Iron Gate Reservoir water quality is a function of hydrology, operating conditions, inflow water quality, and meteorological conditions.

Reservoir residence times and water temperatures play a key role in reservoir water quality. Surface water temperature generally increases from January through July then gradually declines from August through December (Deas and Orlob 1999). Thermal stratification begins in March as air temperatures increase, strengthens through the summer and then breaks down with the onset in cooler weather from October or November.

Water quality conditions in Iron Gate Reservoir are generally poor from late spring to mid-fall in most years due to algae blooms, particularly blue-green algae

Aphanizomenon (Campbell 1999, PacifiCorp 2000). High pH conditions (> 9) that are stressful for fish are common in surface waters during summer. Dissolved oxygen levels generally remain adequate for fish in surface waters above the thermocline while dissolved oxygen levels below the thermocline are near zero at the bottom (Deas and Orlob 1999). Fish are likely restricted to shoreline areas and surface waters during the summer due to low dissolved oxygen concentrations. Because suckers are bottom oriented, low near bottom dissolved oxygen concentrations force them to occupy suboptimal habitat. This may lead to increased stress, slower growth, and potentially higher mortality. Water quality conditions are good during late-fall, winter, and spring when the reservoir is mixed and there is lower algal growth (PacifiCorp 2000).

The Iron Gate facility is operated for base load generation and for providing stable flows in the Klamath River downstream from the dam. It also provides required minimum flows downstream from the facility. (USFWS 2002)

Downstream river fluctuation caused by releases at Iron Gate Dam are limited to the lesser of a 3-inch-per-hour or 250 cfs per hour ramp rate as established in the FERC license. Iron Gate reservoir can fluctuate a maximum of about eight feet between normal minimum and full pool elevations. Average daily fluctuation is roughly 0.5 foot. There are no specific requirements established for reservoir fluctuations. (USFWS 2002)

4.3.2 Jenny Creek

Two high waterfalls (20 and 60 feet high) are about 2 miles upstream from the mouth of Jenny Creek completely blocking upstream passage. No information is available on sucker spawning or rearing in Jenny Creek.

Jenny Creek watershed upstream from the falls (RM 2) supports a number of endemic fish and macroinvertebrates (BLM 2000). A number of introduced fish are also supported, primarily in headwater reservoirs. Three endemic fish include: Jenny Creek sucker (*Catastomus rimiculus* ssp.), redband trout (*O. mykiss*), and Klamath speckled dace (*Rhinichthys osculus klamathensis*). The Draft Management Plan/Environmental Impact Statement for Cascade Siskiyou Ecological Emphasis Area, including Jenny Creek watershed, provides a review of natural resources and effects of management practices (BLM 2000).

Water Quality in Jenny Creek

Jenny Creek from the mouth to RM 17.8 is on Oregon's Final 2002 303(d) List for temperature during the summer (Oregon 2003). Jenny Creek water quality is assumed to be much better than Klamath River based on the presence of several water quality sensitive indicators including the Jenny Creek sucker, redband trout, and freshwater mollusks.

4.4 Northern Spotted Owl

Loss and fragmentation of suitable habitat is the primary threat to the northern spotted owl (Federal Register 55:26114, Federal Register 57:1796; Tuchmann 1996; Alford, et al. 2001). This is due primarily to timber harvest practices, particularly when even-aged (i.e., clearcutting) rather than mixed-aged techniques are used. At the time of listing, more than 90 percent of the timber harvest throughout the range of the spotted owl was accomplished using clearcutting methods that produced even-aged stands. In addition, timber management regimes at that time indicated it was most economically beneficial to harvest stands aged 60-90 years, the approximate age at which these stands are beginning to support spotted owls. This reduction in habitat forces spotted owls to crowd into areas that can support the species. If alternate suitable habitat does exist, it will often be forced over carrying capacity, reducing the viability of the spotted owls residing therein (Federal Register 55:26114).

Over 150 northern spotted owl breeding territories exist in forested lands throughout the Rogue River basin (ONHP 2000). However, northern spotted owls do not forage on fish or other aquatic species that would attract them to Project reservoirs, nor do they depend on habitat provided by Project facilities. Most of the breeding territories are above elevation 3500 feet in mature or old growth forest.

4.5 Bald Eagles

The historic distribution of bald eagles included most of the North American continent. A steep decline in reproduction from 1947 to 1970 is attributed to widespread use of organochloride pesticides (USFWS 1986). Habitat degradation, illegal harassment and disturbance, poisoning, and reduced food base also contributed to the decline. Bald eagle populations have increased steadily since listing under the ESA. The improvement is a direct result of bans on DDT and other persistent organochloride pesticides, habitat protection, and a growing public awareness of the bald eagles' plight.

The Project reservoirs are in the bald eagle California/Oregon Coast Recovery Zone (RZ 23) which includes 23 known breeding territories. Of these, 21 were occupied in 2002 and 14 (70 percent) were successful and fledged an average of 1.15 eaglets per occupied territory. In the five year period from 1998-2002, 56 percent of occupied territories have been successful and have produced an average of 0.89 eaglets per occupied territory. The Pacific Bald Eagle Recovery Plan goal is a 5-year average of 1.0 eaglet produced per occupied nest and a nesting success average of 65 percent. State-wide, 2002 saw 408 eaglets hatched in 401 breeding territories (1.06 eaglets/occupied territory, 66 percent overall breeding success). Table 4-15 provides a historical summary of bald eagle nesting success at water bodies in the action area.

Emigrant Lake

Emigrant Lake Park is open year round for day use and the campground is open from March through October with peak use from May through Labor Day (Reclamation 1995). The park provides recreational use including a park, campground, ball field, waterslide, boat ramps, and parking lots. There is a considerable amount of human activity in the summer months.

A former nest site approximately 2 miles southwest from Emigrant Lake between Hill and Neil Creeks had been observed since its 1993 discovery (Table 4-15). The nest tree was a live Ponderosa pine on privately owned timber land (Popp and Isaacs 1995). Despite seven consecutive annual attempts to raise young, the eagle pair at Emigrant was never able to successfully fledge an eaglet. The nest came down in 2000. The eagle pair built a new nest at nearby Slide Creek on BLM lands in 2001 and has successfully bred and flegded one chick in 2001 and one in 2002. This pair probably continues to fish at Emigrant Lake and pirate prey from the local ospreys.

A draft management plan for the defunct nest was written by Oregon Eagle Foundation in cooperation with Reclamation, BLM, USFS, and ODFW (Popp and Isaacs 1995). This nest site was unique because the nest was higher above its food source than any other bald eagle nest in Oregon (Isaacs 2001). The difference between the surface of the lake and the nest, an elevation of approximately 2500 feet, was likely to have been a significant factor in its lack of production (Wray 2001). Emigrant Lake eagle observations in 1994 and 1995 identified human disturbances that caused eagles to leave their perches especially during peak recreational use of the reservoir in June and July (Popp and Isaacs 1995) indicating that human presence may have also been a contributing factor in this nest's failure to produce young.

Hyatt Reservoir

The one known established breeding site on the east shore of Hyatt Reservoir has a long history of nesting data (Table 4-15). Twenty-seven chicks have fledged at Hyatt since 1971 when eagle monitoring began. Ten instances of failure to nest or breed have occurred in 32 years and the site remained vacant during the 1977 season. The last 5-year success rate is 80 percent and average young produced is 1.0 per occupied nest. Fish, the primary prey of eagles at this location, is often obtained by stealing from osprey that also forage at the reservoir (Kaiser 2001). The reservoir freezes over almost every year and wintering eagles are infrequently observed (Arnold 2001). The piscicide, rotenone, was applied to Hyatt Reservoir in fall 1989 to control a large population of brown bullhead in the reservoir but nest production was stable in following years.

The BLM refers to the recreational facilities around Hyatt Reservoir collectively as the Hyatt Reservoir Recreation Complex. These include two private resorts and two BLM campgrounds that open in April and close in October. The larger BLM campground, Main Campground, has 47 sites for RVs and tent camping, a group day-use area for up to 150 people, a softball field, volleyball court, playground, and two boat ramps and dock facilities. The smaller BLM campground, Wildcat Campground, has 14 sites and one boat ramp. The resorts offer boat rentals, restaurants, and boat ramps. The reservoir is stocked with rainbow trout for fishing. A 10-mph boat speed limit prevents water skiing or similar water activities. A segment of the Pacific Crest Trail winds around the reservoir from the southern shore and along the eastern shore and continues to Howard Prairie Lake.

Howard Prairie Lake

Howard Prairie Lake supports nest sites on its west, north, and south shores (Table 4-15). The west shore nest location fledged one chick annually from 1997 to 1998 and from 2000 to 2001, and two chicks in 1999. No chicks survived in 2002 despite breeding activity in the area of the western nest. The nest has averaged 1 young per year. The second nest site, north of the reservoir, has had sporadic success since the first recorded nesting in 1983; successfully fledging ten chicks in 17 years (0.59 young per year). In 1999 the northern nest came down and the pair has built a new nest on Doe Island which has produced 4 chicks in the 2 years since it was built. The third nest site, south of the reservoir, fledged 8 young in 12 years (0.67 young per year). Eight consecutive breeding seasons, from 1994-2001, either failed to produce offspring despite the presence of adult bald eagles or monitoring crews were not able to determine the reproductive status of the nest (Table 4-15). Then, in 2002, the nest pair fledged 2 eaglets. The reason for the failures and subsequent success remains

Table 4-15. Bald Eagle Nesting Success[1]

Year	Emigrant Lake	Hyatt Reservoir	Howard Prairie Lake		
			West	Doe Island	South
2002	X	1	0	2	2
2001	X	1	1	2	?
2000	X	2	1	X	?
1999	0	0	2	2	?
1998	0	1	1	0	0
1997	0	1	1	0	0
1996	0	0		1	0
1995	0	1		0	0
1994	0	0		0	0
1993	0	1		0	2
1992		1		1	2
1991		1		1	2
1990		1		2	0
1989		0		0	
1988		0		1	
1987		0		0	
1986		1		0	
1985		1		1	
1984		2		0	
1983		0		1	
1982		0			
1981		0			
1980		0			
1979		2			
1978		2			
1977		?			
1976		2			
1975		1			
1974		1			
1973		1			
1972		2			
1971		1			
Total	0	27	6	14	8
Average	0	0.87	1.0	0.74	0.80

1 chicks fledged per breeding territory per year
0: nesting site occupied, but failure to reproduce
?: no available data
X: nest no longer exists

unknown. The last 5-year success rate is 68 percent and average young is 1.01 per occupied breeding area. The reservoir usually remains unfrozen in the winter and over-wintering eagles have been observed (Arnold 2001).

Howard Prairie Lake receives heavy recreational use at the five Jackson County campgrounds and one private resort which surround the lake. Overall, the reservoir has approximately 600 campsites. One of the campgrounds is a designated horse camp, and all of the campgrounds have boat ramps. The reservoir is stocked with rainbow trout, making it a popular fishing location. Peak use at Howard Prairie Lake is from April, with the start of fishing season, through Labor Day.

4.6 Gentner's Fritillary

Gentner's fritillary is threatened by disturbance, alteration, and loss of habitat, and problems associated with small population sizes. Threats to the species include residential development, agricultural land conversion, logging, road construction, recreational activities, off-road vehicle use, bulb collection for gardens, and the small population size. (Federal Register 67:70452)

Habitat loss is associated with rapidly expanding residential construction for homes, roads, driveways; public projects such as schools and landfill expansion; and agricultural conversion, and is the main threat to this species. Timber harvest and recreational activities disturb habitat. Extremely small population sizes leave the species vulnerable to catastrophic events. Ongoing development accounts for 13 percent of habitat losses. Future development may eliminate another 29 percent of habitat. (Federal Register 64:69195)

Invasive weeds and successional encroachment by trees and brush is altering habitat. Records indicate natural fires occurred every 12-15 years and these frequent, low-intensity fires maintained the open canopy normally found within oak woodlands. The transformation from a grassy understory to a shrub understory, along with a dense, closed canopy, is excluding Gentner's fritillary (Federal Register 64:69195). The Nature Conservancy designated the oak woodlands as an endangered habitat and the mixed hardwood and coniferous forests as threatened habitat due to their respective dominant tree species.

Past development extirpated plants from 8 of the 53 originally identified locations. For example, about one-half of a population was bulldozed in 1988 as a result of road construction and dump expansion at Jackson County Landfill. One-fourth of another population occurring at Pelton Road was destroyed in 1990 due to a road-widening project (Federal Register 64:69195).

Each of the three habitats is also threatened due to fire suppression. For example, oak woodlands within this area are becoming more thickly wooded and less grassy due to fire suppression. Residential development also makes prescribed burning difficult. Records indicate natural fires occurred every 12-15 years and these frequent, low-intensity fires maintained the open canopy normally found within oak woodlands. The transformation from a grassy understory to a shrub understory, along with a dense, closed canopy, is excluding Gentner's fritillary (Federal Register 64:69195).

4.7 Large-Flowered Woolly Meadowfoam

Habitat loss and, to a lesser degree, certain livestock grazing practices, off-road vehicle use, and competition with nonnative plants, have decreased the acreage occupied by large-flowered meadowfoam (Federal Register 65:30941).

The large-flowered woolly meadowfoam was observed on five vernal pool systems during 2000-2002 mapping surveys. The distribution of the species has been found to vary from year to year at each location. Mapped habitat for large-flowered woolly meadowfoam decreased from 80 hectares (198 acres) in 1998 to 47 hectares (116 acres) as reported in the 2002 Oregon Natural Heritage Information Center (ONHIC) database. (Federal Register 67:68004) The Nature Conservancy (TNC) manages known sites within the Agate Desert Preserve for protection of the species.

Community development pressure brought about much of this habitat loss. Human population growth in Jackson County is occurring at an extremely rapid rate. Much of this growth is taking place near Medford and White City in the heart of Agate Desert along with an increase in residential, commercial, and industrial development and subsequent loss of vernal pool habitat. Jackson County and the city of Medford development projects impacted much of the original Agate Desert vernal pool habitat occupied by this plant. Other projects, including past game habitat development at Denman Wildlife Area, have eliminated large tracts of habitat (Federal Register 65:30941).

The only large-flowered woolly meadowfoam habitat currently protected from development is on the Agate Desert and Whetstone Savanna Preserves managed by The Nature Conservancy. Approximately 41.2 acres of habitat exists on the preserves and supports the largest populations of the species. However, development plans have been made for lands immediately surrounding the preserves.

Although habitat loss is the primary threat to large-flowered woolly meadowfoam, water projects may have an adverse effect on this species as well. Diversion and blockage of surface runoff feeding the pools can result in premature dry-down before these plants are able to produce seeds prior to going dormant. Supplemental water from outside the natural watershed into vernal pools can change the habitat into a marsh-dominated or a permanent aquatic community where marsh plants may outcompete large-flowered woolly meadowfoam (Borgias 2001).

Physical barriers such as roads and canals may unsuitably deepen a vernal pool upstream from a barrier. Surface runoff can be altered by trenching and other activities that change amounts, patterns, and direction of surface runoff to ephemeral swales and pools.

Invasion of nonnative annual plants in Agate Desert has altered native perennial plant communities (Federal Register 65:30941) where large-flowered woolly meadowfoam grows. Native bunch grasses on mounds between vernal pools have been replaced by introduced European grasses such as brome grass (*Bromus mollis*), medusahead (*Taeniatherum caput-medusae*), dogtail (*Cynosurus echinatus*), and bluegrass (*Poa bulbosa*). Medusahead competes with large-flowered woolly meadowfoam on seasonally wet mounds between the pools. Seeds of large-flowered woolly meadowfoam are not able to germinate under dense thatch produced by these introduced annual species (Federal Register 65:30941).

4.8 Cook's Lomatium

Reasons for decline include industrial, commercial, and residential development, public utility construction and development of utility corridors, land conversion for agricultural uses, weed invasion, roadside spraying, and mowing.

The historical range of Cook's lomatium may have encompassed over 130 square kilometers (50 square miles) in the Agate Desert. The vernal pool habitat upon which this species depends has almost been completely eliminated in Jackson County, Oregon. Mapped habitat totaled 54 hectares (133 acres) in 1998 (Federal Register 67:68004). However, the 2002 ONHIC database showed that the area of occupied habitat had decreased to an estimated 28 hectares (69 acres) (Federal Register 67:68004). The only Cook's lomatium habitat currently protected from development is on the Agate Desert and Whetstone Savanna Preserves managed by The Nature

Conservancy. Approximately 17 acres of habitat exists on the preserves and supports the largest populations of the species.

Community development pressure brought about much of this habitat loss. Human population growth in Jackson County is occurring at an extremely rapid rate. Much of this growth is taking place near Medford and White City in the heart of the Agate Desert with an increase in residential, commercial, and industrial development and subsequent loss of vernal pool habitat. Several of the Jackson County and city of Medford development projects destroyed vernal pool habitat and eliminated populations of Cook's lomatium.

Invasion of nonnative annual plants in Agate Desert has altered native perennial plant communities (Federal Register 65:30941) where Lomatium cookii grows. Native bunch grasses on mounds between vernal pools have been replaced by introduced European grasses such as brome grass (*Bromus mollis*), medusahead (*Taeniatherum caput-medusae*), dogtail (*Cynosurus echinatus*), and bluegrass (*Poa bulbosa*). Medusahead competes with Cook's lomatium on seasonally wet mounds between the pools. The seeds of Cook's lomatium are not able to germinate under the dense thatch produced by these introduced annual species.

Although habitat loss is the primary threat to Cook's lomatium, water projects may have an adverse effect on this species as well. Diversion or blockage of watershed runoff feeding the pools can result in premature dry-down before these plants are able to produce seeds prior to going dormant. Supplemental water from outside the natural watershed into vernal pools can change the habitat into a marsh-dominated or a permanent aquatic community where marsh plants may out compete Cook's lomatium (Borgias 2001).

Physical barriers such as roads and canals may unsuitably deepen a vernal pool upstream of a barrier. Surface runoff can be altered by trenching and other activities that change amounts, patterns, and direction of runoff to ephemeral swales and pools.

4.9 Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp is an obligate vernal pool species relying on the presence of functioning vernal pools for survival. Although habitat loss is the principal danger to vernal pool fairy shrimp, water supply conditions can be a disturbance factor that may affect a substantial portion of the populations. The timing, frequency, and length of inundation of the vernal pool habitat are critical to survival of vernal pool fairy shrimp; any substantial hydrologic change in these factors adversely affects this species (Federal Register 59:48136).

Diversion (or blockage) of surface runoff feeding the pools can result in premature dry-down before the life cycle of these animals is completed. Supplemental water from outside the natural watershed into vernal pools can change the habitat into a marsh-dominated or a permanent aquatic community that is unsuitable for the vernal pool fairy shrimp.

Physical barriers such as roads and canals unsuitably deepen a vernal pool upstream from a barrier and can isolate a fairy shrimp population from a portion of its aquatic habitat. Surface runoff is altered by disturbance from trenching and other activities that change amounts, patterns, and direction of surface runoff to ephemeral drainages. Introduction of water during summer can disrupt the life cycles of vernal pool crustaceans by subjecting them to greater levels of predation by animals such as bullfrogs and predatory fish that require more permanent sources of water.

Human activities, such as urban development and conversion of land to agricultural use, eliminated much of the original vernal pool habitat and threaten remaining habitat (Federal Register 59:48136, Belk 1998, TNC 2000). About 197 acres are protected in The Nature Conservancy's Agate Desert (53 acres) and Whetstone Savannah Preserves (144 acres) (TNC 2000).

Originally, the vernal pools covered about 21,000 acres. The Nature Conservancy indicates only about 7,700 acres of the original vernal pool habitat remains in the area and only about 4,750 acres are in the highest integrity class having intact topography/hydrology and altered vegetation. Only about 2,100 acres have well distributed and abundant vernal pools (Borgias and Patterson 1999).

Vernal pool crustaceans are very sensitive to the water chemistry of their habitats. Pools where fairy shrimp have been found have low total dissolved solids, low conductivity, low alkalinity, and low chloride concentrations (Federal Register 59:48136). Contamination of vernal pools from adjacent areas may injure or kill vernal pool crustaceans.

Certain pesticides are registered by EPA for use on rangelands and these may be sprayed directly on vernal pools. Mosquito abatement activities sometimes also include direct application of pesticides to pools including vernal pools. Some compounds do not degrade in a season, resulting in long-term accumulation (USFWS 2001c, USFWS 2000c). Fertilizer runoff may lead to eutrophication of vernal pools which can kill fairy shrimp by reducing the concentration of dissolved oxygen (Rogers 1998).

Plowing, grading, maintenance of canal roads, and other ground-disturbing activities near vernal pools can result in erosion/siltation problems within the pool the following wet season (Borgias 2001). Vernal pool fairy shrimp breath through lobes similar to gills. Fairy shrimp living in pools with a high amount of siltation may suffocate.

5.0 Rogue River Basin Hydrologic Model

5.1 Introduction

Computer simulations were performed to evaluate the hydrologic effects of Reclamation activities as defined in the proposed action. The computer model is described in detail in Little Butte and Bear Creek Surface Water Distribution Model, *Draft* - Model Version March 26, 2003 (Reclamation 2003). Pisces was developed by Reclamation's Pacific Northwest Regional Office for viewing and portraying model documention. A CD copy of Pisces and the associated database can be found in Appendix B. Modeled system inflows were developed from measured flows and reservoir contents from water years 1962 through 1999. Two scenarios were modeled:

1. The "with Reclamation" scenario simulates the current facilities and operations of Little Butte and Bear Creeks in the Rogue River basin and of Jenny Creek and Fourmile Creek diversions in the Klamath River basin. Federal and non-Federal facilities are included in the scenario. ***The proposed action is the operations of Federal facilities within the "with Reclamation" scenario***.
2. The "without Reclamation" scenario removes the operation of Reclamation storage facilities and Reclamation transbasin diversions from the "with Reclamation" scenario.

The "without Reclamation" scenario differs from the "with Reclamation" scenario in that:

- Reclamation reservoirs Emigrant, Howard Prairie, Hyatt, Agate, and Keene Creek do not operate and, instead, pass flows
- Diversions from the South Fork of Little Butte Creek in the Rogue River basin to Howard Prairie Lake in the Klamath River basin do not occur. These diversions are the Dead Indian Collection Canal and the South Fork Little Butte Collection Canal near Pinehurst (Deadwood Tunnel)
- The Howard Prairie Delivery Canal and Green Springs Tunnel and spillway do not operate. These facilities would normally transport combined flows from Howard Prairie Lake and Hyatt Reservoir, and the partially intercepted flows from Soda Creek, Little Beaver Creek, and Keene Creek in the Klamath River basin to Emigrant Reservoir in the Rogue River basin.

Reclamation reservoirs in the "without Reclamation" scenario forego their right to fill. Natural flow which would have been stored, is made available for distribution to other water rights holders in priority. Private facilities respond to the absence of Reclamation facility operations.

The major facilities and modeled operations for each scenario are listed in Table 5-1, Table 5-2, and Table 5-3.

Table 5-1. Modeled Storage Facilities

Reclamation Reservoirs	With Reclamation	Without Reclamation
Emigrant Lake	stores and releases Project water	does not operate
Howard Prairie Lake	stores and releases Project water	does not operate
Hyatt Reservoir	stores and releases Project water	does not operate
Agate Lake	re-regulates private water	does not operate
Private Reservoirs	**With Reclamation**	**Without Reclamation**
Fourmile Lake	stores and releases private water	stores and releases private water
Fish Lake	stores and releases private water	stores and releases private water

Table 5-2. Modeled Irrigation Diversions

Reclamation Project Diversions	With Reclamation	Without Reclamation
TID diverts from Emigrant and Bear Creeks through Ashland Canal, East Lateral (serving East and West Canals), and Talent Canal at Oak Street Diversion Dam	natural flow and stored flow from Project reservoirs	natural flow
MID diverts from Bear Creek through Phoenix Canal	natural flow and stored flow from Project reservoirs	natural flow
RRVID diverts from Bear Creek through Bear Creek Canal at Jackson Street Diversion	natural flow and stored flow from Project reservoirs	natural flow

Private Diversions	With Reclamation	Without Reclamation
RRVID and MID divert from North Fork Little Butte Creek into Joint System Canal	natural flow and stored flow from Fourmile and Fish Lakes	natural flow and stored flow from Fourmile and Fish Lakes
RRVID and MID divert from South Fork Little Butte Creek into Joint System Canal	natural flow	natural flow

Table 5-3. Modeled Transbasin Diversion Facilities

Reclamation Diversions	With Reclamation	Without Reclamation
Dead Indian Collection Canal and South Fork Little Butte Collection Canal near Pinehurst (Deadwood Tunnel) divert from tributaries to South Fork Little Butte Creek in Rogue River basin to Howard Prairie Lake in Klamath River basin.	operates	does not operate
Howard Prairie Delivery Canal and Green Springs Tunnel and spillway transport the combined flows from Howard Prairie Lake and Hyatt Reservoir, and intercepted flows from Soda Creek, Little Beaver Creek, and Keene Creek in Klamath River basin to Emigrant and Bear Creeks in Rogue River basin.	operates	does not operate
Private Canals	**With Reclamation**	**Without Reclamation**
Cascade Canal delivers flows from Fourmile Lake in Klamath River basin to Fish Lake in Rogue River basin.	operates	operates

5.2 Determination of Flow Impacts

Modeled flows are provided at the seven calibration locations on Emigrant, Bear and Little Butte Creeks described in Table 5-4 and shown on Figure 5-1.

Table 5-4. Model Calibration Locations

Gage Name	USGS	Location
Emigrant Creek below Emigrant Dam	14350000	Emigrant/Bear Creek RM 29.2
Bear Creek below Ashland Creek[1]	14354200	Ashland Creek enters Bear Creek at RM 21.1
Bear Creek at Medford	14357500	Bear Creek RM 9.9
Bear Creek above Jackson Creek[2]	14358700	Jackson Creek enters Bear Creek at RM 2.0
North Fork Little Butte Creek below Fish Lake	14342500	Fish Lake Dam is at Little Butte Creek RM 15.8
South Fork Little Butte Creek near Lake Creek, above south intake to Joint System Canal[3].	14341500	Little Butte Creek RM 18.1
Little Butte Creek at Lake Creek[4], below confluence of North and South Forks	14346700	confluence of North and South Forks is at Little Butte Creek RM 17.2

[1] available starting in water year 1990
[2] available water year 1969 only
[3] discontinued in water year 1982
[4] discontinued in water year 1989; restarted in water year 2001

Modeled average monthly flows at the 10, 50, and 90 percent exceedance levels for the "without Reclamation" and the "with Reclamation" scenarios are shown in Table 5-5, Table 5-6 and Table 5-7 .

The flow effects due to the proposed action (also shown in Table 5-5, Table 5-6 and Table 5-7) are determined by subtracting the "without Reclamation" scenario flows from the "with Reclamation" scenario flows. Although this approach does not distinguish flow differences on a year by year basis, it can be used to evaluate the magnitude and trends of the proposed action effects.

An exceedance level is the probability that a value is equaled or exceeded. For example, in Table 5-5, at Bear Creek at Medford, for the "with Reclamation" scenario, there is a 10 percent probability that modeled average monthly October flows will equal or exceed 52 cfs. There is a 50 percent probability that modeled average monthly October flows will equal or exceed 30 cfs. There is a 90 percent probability that modeled average monthly October flows will equal or exceed 12 cfs.

Flows at the 10 percent level are interpreted as high flows; 50 percent level flows are median flows; and 90 percent level flows are low flows.

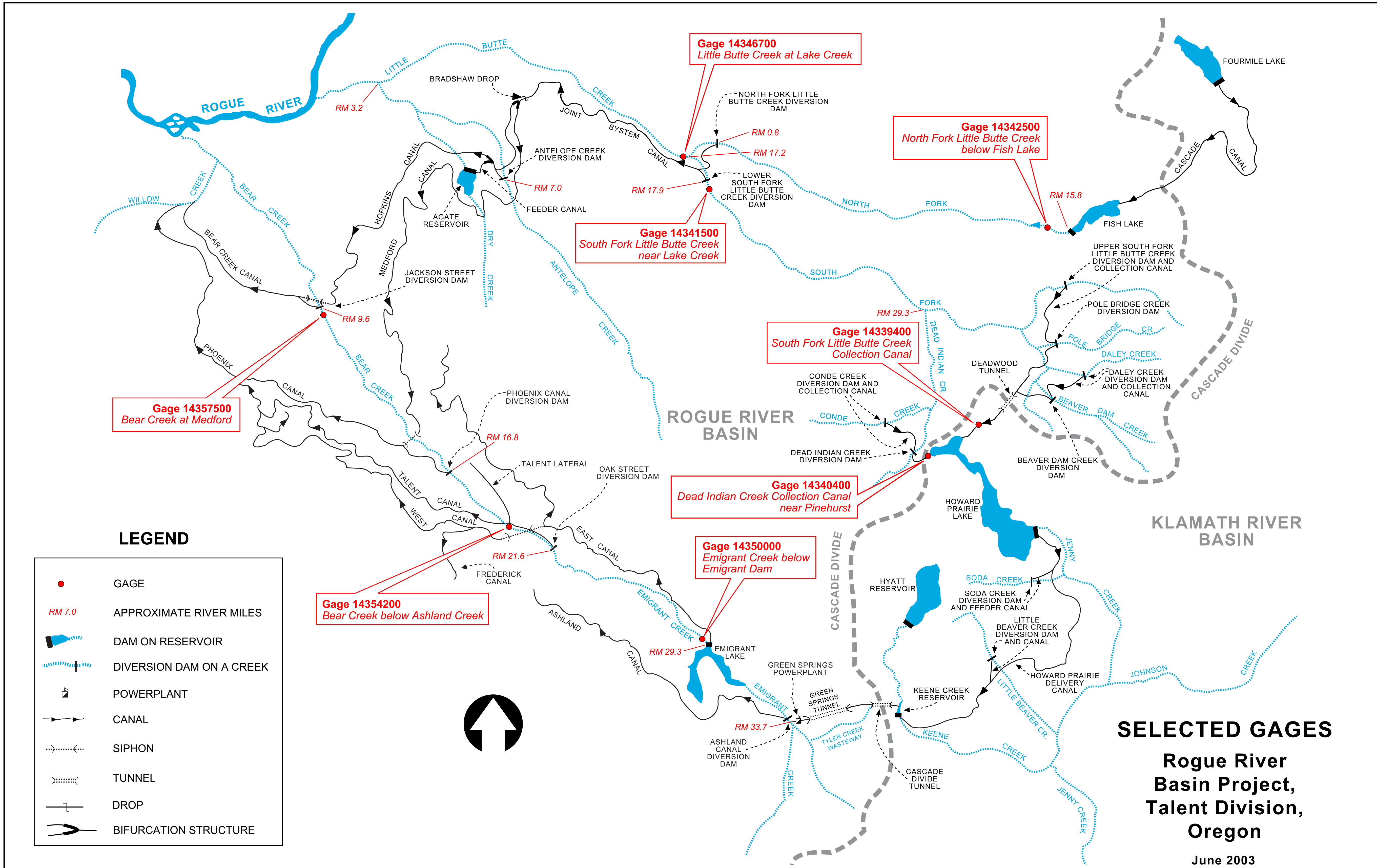
SELECTED GAGES
Rogue River Basin Project, Talent Division, Oregon
June 2003
LEGEND
GAGE
RM 7.0 APPROXIMATE RIVER MILES
DAM ON RESERVOIR
DIVERSION DAM ON A CREEK
POWERPLANT
CANAL
SIPHON
TUNNEL
DROP
BIFURCATION STRUCTURE
Gage 14346700
Little Butte Creek at Lake Creek
Gage 14342500
North Fork Little Butte Creek below Fish Lake
Gage 14341500
South Fork Little Butte Creek near Lake Creek
Gage 14339400
South Fork Little Butte Creek Collection Canal
Gage 14357500
Bear Creek at Medford
Gage 14340400
Dead Indian Creek Collection Canal near Pinehurst
Gage 14350000
Emigrant Creek below Emigrant Dam
Gage 14354200
Bear Creek below Ashland Creek
ROGUE RIVER BASIN
KLAMATH RIVER BASIN
CASCADE DIVIDE
ROGUE RIVER
FOURMILE LAKE
FISH LAKE
HOWARD PRAIRIE LAKE
HYATT RESERVOIR
EMIGRANT LAKE
AGATE RESERVOIR
KEENE CREEK RESERVOIR
BRADSHAW DROP
ANTELOPE CREEK DIVERSION DAM
FEEDER CANAL
JACKSON STREET DIVERSION DAM
NORTH FORK LITTLE BUTTE CREEK DIVERSION DAM
LOWER SOUTH FORK LITTLE BUTTE CREEK DIVERSION DAM
UPPER SOUTH FORK LITTLE BUTTE CREEK DIVERSION DAM AND COLLECTION CANAL
POLE BRIDGE CREEK DIVERSION DAM
DALEY CREEK DIVERSION DAM AND COLLECTION CANAL
DEADWOOD TUNNEL
CONDE CREEK DIVERSION DAM AND COLLECTION CANAL
DEAD INDIAN CREEK DIVERSION DAM
BEAVER DAM CREEK DIVERSION DAM
PHOENIX CANAL DIVERSION DAM
TALENT LATERAL
OAK STREET DIVERSION DAM
FREDERICK CANAL
SODA CREEK DIVERSION DAM AND FEEDER CANAL
LITTLE BEAVER CREEK DIVERSION DAM AND CANAL
HOWARD PRAIRIE DELIVERY CANAL
GREEN SPRINGS POWERPLANT
GREEN SPRINGS TUNNEL
TYLER CREEK WASTEWAY
ASHLAND CANAL DIVERSION DAM
CASCADE DIVIDE TUNNEL
JOINT SYSTEM CANAL
CASCADE CANAL
BEAR CREEK CANAL
HOPKINS CANAL
MEDFORD CANAL
PHOENIX CANAL
TALENT CANAL
WEST CANAL
EAST CANAL
ASHLAND CANAL
LITTLE BUTTE CREEK
NORTH FORK
SOUTH FORK
WILLOW CREEK
BEAR CREEK
DRY CREEK
ANTELOPE CREEK
DEAD INDIAN CR
POLE BRIDGE CR
DALEY CREEK
CONDE CREEK
BEAVER DAM CREEK
EMIGRANT CREEK
SODA CREEK
JENNY CREEK
JOHNSON CREEK
KEENE CREEK
LITTLE BEAVER CR
RM 3.2
RM 7.0
RM 0.8
RM 17.2
RM 17.9
RM 15.8
RM 9.6
RM 29.3
RM 16.8
RM 21.6
RM 29.3
RM 33.7

Figure 5-1

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5.2.1 Emigrant and Bear Creeks

Emigrant and Bear Creeks modeled flows are shown in Table 5-5, Table 5-6, and summarized below.

Months	Effects Due to Reclamation	Reasons
November – May	Decrease flows	Diversion and storage
June	Decrease high flows Increase low flows	Storage and release
July – October	Increase flows	Release and return flows

November through May

Reclamation activities decrease flows November through May due to storing natural flow in Emigrant Reservoir. In other words, “with Reclamation” flows are generally less than “without Reclamation” flows.

June

Reclamation activities tend to decrease high flows and increase low flows in Bear Creek in June. “With Reclamation” high flows are less than “without Reclamation” high flows in June due to storing natural flow in Emigrant Reservoir, especially when natural inflows to Bear Creek and its tributaries downstream from the dam are sufficient to satisfy irrigation requirements. In Emigrant Creek below Emigrant Dam, flow reduction occurs below the 6 percent exceedence level.

“With Reclamation” low flows are greater than “without Reclamation” low flows in June due to the release of natural flows and stored flows from Project reservoirs, including transbasin diversions.

July through October.

Reclamation activities increase flows July though October.

“With Reclamation” flows are greater than “without Reclamation” flows during this period due to the release of natural flows and stored flows from Project reservoirs, including transbasin diversions. Return flows from irrigated lands also contribute to flow increases.

5.2.2 South Fork Little Butte Creek Near Lake Creek

South Fork Little Butte Creek near Lake Creek modeled flows are shown in Table 5-7 and summarized below.

Months	Effects Due to Reclamation	Reasons
November – May	Decrease flows	Diversion and storage
June	Decrease high flows Little effect on median and low flows	Diversion and storage
July – October	Decrease flows	Diversion and storage

November through May

Reclamation activities decrease flows in the South Fork Little Butte Creek near Lake Creek November through May.

"With Reclamation" flows are less than "without Reclamation" flows during this period due to the transbasin diversion of water through the Dead Indian and the South Fork Little Butte Collection Canals. Transbasin diversions occur throughout the year, but decline throughout the summer.

June

Reclamation activities decrease high flows and have little effect on median and low flows in the South Fork Little Butte Creek near Lake Creek November through May.

"With Reclamation" high flows are less than "without Reclamation" high flows in June due to the transbasin diversion of water through the Dead Indian and the South Fork Little Butte Collection Canals.

July through October

Reclamation activities decrease flows insignificantly in the South Fork Little Butte Creek near Lake Creek July through October.

"With Reclamation" flows are slightly less than "without Reclamation" flows because small or infrequent transbasin diversions occur through the Dead Indian and the South Fork Little Butte Collection Canals during this period.

5.2.3 Little Butte Creek at Lake Creek

Little Butte Creek at Lake Creek modeled flows are shown in Table 5-7 and summarized below.

Months	Effects Due to Reclamation	Reasons
November – December	Increase low flows Small effect on median and high flows	Diversion and storage
January – May	Decrease flows	Diversion
June – October	Increase flows	Release

November and December

Reclamation activities and private activities in response to Reclamation's operations increase low flows in November and December and have only small effects on median and high flows.

Diversions through the Dead Indian and the South Fork Little Butte Collection Canals during low flow periods are small as shown in the table below and do not contribute significantly to low flow effects of the "with Reclamation" scenario at Lake Creek. Therefore, the "with Reclamation" low flows are greater than "without Reclamation" low flows for November and December because, in the "without Reclamation" scenario, water is being stored in Fish Lake in an effort to recover from large summer drawdowns.

Average Daily Diversion from South Fork to Howard Prairie(cfs)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
3	10	17	25	22	37	24	38	20	7	2	1

The table shows historic observed values for water years 1991 to 1999. Gages: Dead Indian 14340400 and Deadwood Tunnel 14339400

In the “with Reclamation” scenario, median and high flows for November and December are similar to median and high “without Reclamation” flows because, in the “with Reclamation” scenario, the flow decreasing effects of diversions through the Dead Indian and the South Fork Little Butte Collection Canals are offset by the non-Federal release of stored water from Fish Lake.

January through May

Reclamation activities and private activities in response to Reclamation’s operations decrease January through May flows in Little Butte Creek at Lake Creek.

“With Reclamation” flows are generally less than “without Reclamation” flows during this period due to the effects of diversions through the Dead Indian and South Fork Little Butte Collection Canals which are not offset by the release of stored water from Fish Lake.

June through October

Reclamation activities and private activities in response to Reclamation’s operations increase June through October flows in Little Butte Creek at Lake Creek (Figure 5-1).

“With Reclamation” flows in Little Butte Creek are frequently less than “without Reclamation” flows due to private diversions into the Joint System Canal and Reclamation diversions in upper South Fork Little Butte Creek.

Table 5-5. Emigrant and Bear Creek Modeled Flow Effects

	Emigrant Creek below Emigrant Dam				Bear Creek below Ashland Creek				Bear Creek at Medford			
Percent Exceedance	"With Reclamation"	"Without Reclamation"	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of "Without Reclamation"	"With Reclamation"	"Without Reclamation"	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of "Without Reclamation"	"With Reclamation"	"Without Reclamation"	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of "Without Reclamation"
(%)	(cfs)	(cfs)	(cfs)	(%)	(cfs)	(cfs)	(cfs)	(%)	(cfs)	(cfs)	(cfs)	(%)
	October				October				October			
10	9	12	-3	-25	29	30	-1	-3	52	53	-1	-2
50	0	0	0		19	15	4	27	30	27	3	11
90	0	0	0		9	4	5	125	12	9	3	33
	November				November				November			
10	70	133	-63	-47	132	238	-106	-45	189	295	-106	-36
50	0	4	-4	-100	27	28	-1	-4	44	41	3	7
90	0	0	0		12	12	0	0	17	17	0	0
	December				December				December			
10	152	200	-48	-24	674	595	79	13	764	682	82	12
50	0	28	-28	-100	67	79	-12	-15	95	110	-15	-14
90	0	0	0		19	19	0	0	32	32	0	0
	January				January				January			
10	180	231	-51	-22	405	572	-167	-29	605	769	-164	-21
50	0	78	-78	-100	98	139	-41	-29	150	193	-43	-22
90	0	8	-8	-100	21	35	-14	-40	38	50	-12	-24
	February				February				February			
10	100	233	-133	-57	215	324	-109	-34	338	435	-97	-22
50	0	95	-95	-100	100	203	-103	-51	136	259	-123	-47
90	0	7	-7	-100	27	27	0	0	42	42	0	0
	March				March				March			
10	128	239	-111	-46	322	461	-139	-30	392	527	-135	-26
50	1	128	-127	-99	125	222	-97	-44	163	278	-115	-41
90	0	23	-23	-100	24	47	-23	-49	31	55	-24	-44

	Emigrant Creek below Emigrant Dam				Bear Creek below Ashland Creek				Bear Creek at Medford			
Percent Exceedance	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”
	April				**April**				**April**			
10	185	218	-33	-15	330	379	-49	-13	437	482	-45	-9
50	55	110	-55	-50	146	205	-59	-29	176	262	-86	-33
90	0	30	-30	-100	34	41	-7	-17	19	60	-41	-68
	May				**May**				**May**			
10	119	182	-63	-35	253	315	-62	-20	315	417	-102	-24
50	21	60	-39	-65	88	122	-34	-28	121	178	-57	-32
90	0	20	-20	-100	28	36	-8	-22	26	63	-37	-59
	June				**June**				**June**			
10	61	62	-1	-2	120	148	-28	-19	167	209	-42	-20
50	29	27	2	7	59	76	-17	-22	64	95	-31	-33
90	4	5	-1	-20	27	17	10	59	19	17	2	12
	July				**July**				**July**			
10	89	38	51	134	86	55	31	56	57	60	-3	-5
50	67	12	55	458	59	37	22	59	31	21	10	48
90	35	0	35		43	16	27	169	20	19	1	5
	August				**August**				**August**			
10	95	37	58	157	83	52	31	60	88	66	22	33
50	59	0	59		55	25	30	120	53	20	33	165
90	43	0	43		34	10	24	240	21	15	6	40
	September				**September**				**September**			
10	51	28	23	82	71	54	17	31	92	63	29	46
50	27	1	26	2600	31	16	15	94	53	27	26	96
90	5	0	5		5	0	5		25	14	11	79

Table 5-6. Emigrant and Bear Creek Modeled Flow Effects

Bear Creek above Jackson Creek				
Percent Exceedance	**"With Reclamation"**	**"Without Reclamation"**	**Flow Effects - Proposed Action**	**Flow Effects of Proposed Action - Percent of "Without Reclamation"**
(%)	(cfs)	(cfs)	(cfs)	(%)
	October			
10	80	75	5	7
50	45	37	8	22
90	15	7	8	114
	November			
10	208	309	-101	-33
50	60	53	7	13
90	38	28	10	36
	December			
10	766	684	82	12
50	97	113	-16	-14
90	34	36	-2	-6
	January			
10	605	769	-164	-21
50	150	193	-43	-22
90	38	50	-12	-24
	February			
10	338	435	-97	-22
50	136	259	-123	-47
90	42	42	0	0
	March			
10	392	527	-135	-26
50	163	278	-115	-41
90	31	55	-24	-44
	April			
10	432	486	-54	-11
50	174	266	-92	-35
90	19	59	-40	-68

Bear Creek above Jackson Creek				
Percent Exceedance	**“With Reclamation”**	**“Without Reclamation”**	**Flow Effects - Proposed Action**	**Flow Effects of Proposed Action - Percent of “Without Reclamation”**
		May		
10	330	431	-101	-23
50	138	188	-50	-27
90	24	63	-39	-62
		June		
10	190	241	-51	-21
50	93	119	-26	-22
90	19	1	18	1800
		July		
10	67	59	8	14
50	40	22	18	82
90	23	0	23	
		August		
10	106	70	36	51
50	73	18	55	306
90	24	0	24	
		September		
10	136	94	42	45
50	79	46	33	72
90	34	0	34	

Table 5-7. South Fork and Little Butte Creek Modeled Flow Effects

	South Fork Little Butte Creek Near Lake Creek				Little Butte Creek at Lake Creek			
Percent Exceedance	"With Reclamation"	"Without Reclamation"	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of "Without Reclamation"	"With Reclamation"	"Without Reclamation"	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of "Without Reclamation"
(%)	(cfs)	(cfs)	(cfs)	(%)	(cfs)	(cfs)	(cfs)	(%)
	October				**October**			
10	45	47	-2	-4	83	52	31	60
50	18	21	-3	-14	55	31	24	77
90	14	17	-3	-18	37	24	13	54
	November				**November**			
10	104	112	-8	-7	198	204	-6	-3
50	46	51	-5	-10	114	112	2	2
90	18	25	-7	-28	77	59	18	31
	December				**December**			
10	339	390	-51	-13	504	538	-34	-6
50	99	108	-9	-8	236	231	5	2
90	24	41	-17	-41	123	108	15	14

	South Fork Little Butte Creek Near Lake Creek				Little Butte Creek at Lake Creek			
Percent Exceedance	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”
	January				**January**			
10	357	419	-62	-15	462	503	-41	-8
50	137	150	-13	-9	230	236	-6	-3
90	32	44	-12	-27	110	113	-3	-3
	February				**February**			
10	256	279	-23	-8	445	479	-34	-7
50	104	149	-45	-30	235	264	-29	-11
90	49	73	-24	-33	164	150	14	9
	March				**March**			
10	341	356	-15	-4	513	524	-11	-2
50	133	182	-49	-27	270	313	-43	-14
90	55	88	-33	-38	159	187	-28	-15
	April				**April**			
10	345	371	-26	-7	489	474	15	3
50	230	291	-61	-21	314	335	-21	-6

	South Fork Little Butte Creek Near Lake Creek				Little Butte Creek at Lake Creek			
Percent Exceedance	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”
90	77	123	-46	-37	107	120	-13	-11
	May				**May**			
10	368	417	-49	-12	417	445	-28	-6
50	141	201	-60	-30	173	175	-2	-1
90	61	94	-33	-35	50	65	-15	-23
	June				**June**			
10	93	132	-39	-30	111	87	24	28
50	57	63	-6	-10	37	24	13	54
90	33	34	-1	-3	15	15	0	0
	July				**July**			
10	38	43	-5	-12	47	27	20	74
50	26	30	-4	-13	26	24	2	8
90	15	15	0	0	17	17	0	0
	August				**August**			
10	28	28	0	0	46	24	22	92

	South Fork Little Butte Creek Near Lake Creek				Little Butte Creek at Lake Creek			
Percent Exceedance	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”	“With Reclamation”	“Without Reclamation”	Flow Effects - Proposed Action	Flow Effects of Proposed Action - Percent of “Without Reclamation”
50	21	21	0	0	30	24	6	25
90	12	13	-1	-8	16	16	0	0
	September				**September**			
10	25	25	0	0	56	25	31	124
50	18	19	-1	-5	34	24	10	42
90	14	14	0	0	17	17	0	0

Chapter 6.0 Effects of the Proposed Action

6.1 Introduction

"Effects of the action" refers to the direct and indirect effects of a proposed action on listed species or critical habitat, together with the effects of other activities that are interrelated to or interdependent with that action.

In accordance with the provisions of the ESA implementing regulations and the USFWS Section 7 Handbook, Reclamation uses the following definitions to make its effects determinations for each listed species:

May Affect - Likely to adversely affect (MA/LAA): Any adverse effect to ESA-listed species or their critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of is not likely to adversely affect). In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action is likely to adversely affect the listed species. If incidental take is anticipated to occur as a result of the proposed action, and is likely to adversely affect determination should be made.

May Affect - Not likely to adversely affect (MA/NLAA): Effects on ESA-listed species or their critical habitat are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

No effect (NE): When the action agency determines its proposed action will not affect listed species or critical habitat.

6.2 SONCC Coho Salmon

This section describes the effects of the proposed action on SONCC coho salmon inhabiting the Rogue River basin and the mainstem Klamath River downstream from Iron Gate Dam. Hydrology and habitat approaches are used to analyze effects.

6.2.1 Rogue River Basin

Analysis Approach

The lack of hydrology data and existing fish flow needs data limit the Rogue River basin hydrology analysis mainly to a qualitative discussion of effects on coho salmon in the Rogue River basin. Streamflow data collection has been inconsistent over the years and records are incomplete. Many stream gages haven't operated for extended periods of time. The Facilities and Operations report (Vinsonhaler 2002) discusses periods of no data collection. This section describes the approach for identifying effects of operations on SONCC coho salmon inhabiting Little Butte Creek and Bear Creek watersheds.

The Rogue River basin, the Little Butte and Bear Creek Surface Water Distribution Model, DRAFT Model Version March 26, 2003 (Reclamation 2003) was used to simulate "without Reclamation" and "with Reclamation" stream flows. Psces was developed by Reclamation's Pacific Northwest Regional Office for viewing and portraying data. A CD copy of Pisces and the associated database can be found in Appendix B. "With Reclamation" monthly exceedance flows were modeled at various locations in Little Butte Creek and Bear Creek drainages and compared to "without Reclamation" flows to determine the effects of the proposed action. An exceedance flow is the flow that is equaled or exceeded a certain percentage of the time. Flows at the 10 percent level can be interpreted as high flows; 50 percent level flows are median flows; and 90 percent level flows are low flows. Flow effects due to the "with Reclamation", as a percentage of the "without Reclamation," were considered minor if less than or equal to 10 percent, moderate from 11-20 percent; and major if greater than 20 percent. The rational for these percentages is similar to that used by NMFS (2002). Where possible, "with Reclamation" and "without Reclamation" flows were compared to seasonal OWRD instream flow water rights (Tables 4-3 and 4-6) at the 50 percent exceedance level to assess potential impacts on coho salmon.

Effects on Fry, Juvenile, and Smolt Life Stages from February through June

The requirements of fry, juvenile, and smolt coho salmon during this time period include shallow gravel areas, rearing habitat consisting of a mixture of pools and riffles, instream and bank cover, and low amount of fine sediments.

During this time period, Reclamation is diverting water through Dead Indian and South Fork Little Butte Collection Canals for storage in Howard Prairie Lake and storing natural flow water in Emigrant Lake. Some release of natural and stored flows may begin in June in the Bear Creek system.

South Fork Little Butte Creek and Tributary Streamflows

Aquatic habitat conditions in South Fork Little Butte Creek affected (directly and indirectly) by operations are streamflow, water quality, and fish passage.

South Fork Little Butte Creek is impaired from a flow modification standard because irrigation water withdrawal causes low streamflows. However, several tributaries to this stream increases natural streamflow and provides improved spawning and rearing conditions for coho salmon and steelhead. Coho salmon and steelhead spawn throughout this stream and its tributaries in most years. Coho salmon fry habitat becomes increasingly important in the spring as irrigation depletions within tributaries begin to limit available salmon fry habitat in those tributaries, especially in drier years. Also, coho salmon fry must compete with other species for available habitat in the spring. Out-migrating coho salmon smolts must use the tributaries as they travel to the sea. Juvenile coho salmon from the previous year's cohort transform to the smolt life stage and migrate toward the sea during the spring. The size of the fish, flow conditions, water temperature, dissolved oxygen levels, day length, and the availability of food all tend to affect the time of migration (Sandercock 1991).

Table 5-7 compares "without Reclamation" and "with Reclamation" monthly flows for South Fork Little Butte Creek flows near Lake Creek.

In the February to June time period, "with Reclamation" results in major flow decreases at exceedance levels equal to or greater than 50 percent (average and dry water years) in February, March, April and May. The only major flow change occurs in June at the 10 percent exceedance (greater than average water year) level (39 cfs decrease). This may result in decreased availability of resources for fry and juvenile coho salmon in South Fork Little Butte Creek, particularly during average and dry water years. Coho salmon fry and juveniles may be affected by major flow decreases resulting from "with Reclamation" by decreased carrying capacity and displacement into less suitable habitat. As a result, survival of young coho salmon may be affected in drier water years. However, it should be noted that average "with Reclamation" and "without Reclamation" flows would exceed OWRD instream flow water rights in South Fork Little Butte Creek at the mouth in March, April, and May. Both modeled scenarios would be less than the instream flow reservation in June. In February, only "with Reclamation" flows at the 50 percent exceedance level (104 cfs) would be less than the flow reservation of 120 cfs. Although there are no empirical data demonstrating a clear association between a reduction in Rogue River basin tributary flows and the recruitment and survival of coho salmon, this issue has been studied extensively (NMFS 2002). Several studies, Cada et al. (1994), Giorgi (1993), and Berggren and Filardo (1993), in other geographic areas generally supported the premise that increased flow led to increased smolt survival.

Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in South Fork Little Butte Creek.

Little Butte Creek

Table 5-7 compares "without Reclamation" and "with Reclamation" monthly flows in Little Butte Creek at Lake Creek.

Under present habitat conditions, Little Butte Creek provides an important seasonal migration corridor for upstream and downstream migrating salmon and steelhead. In general, "with Reclamation" flows are slightly less than "without Reclamation" flows. The only major flow effects occur in May and June. In May, "with Reclamation" flows are 50 cfs in a dry year compared to 65 cfs under "without Reclamation" conditions; a reduction of 15 cfs or a 23 percent reduction. In June, "with Reclamation" flows are 111 and 37 cfs in wet and average water years, respectively. This compares with "without Reclamation" flows of 87 and 24 cfs, or 28 percent and 54 percent flow increases.

At least 24 cfs must be passed to meet downstream senior water rights in Little Butte Creek when Federal and non-Federal facilities are diverting from North Fork and South Fork Little Butte Creek. North Fork and lower South Fork Little Butte Creek Diversion Dams share in passing this water to provide some flow in both streams downstream from the diversion dams (Bradford 2001). The ODFW's Little Butte Creek instream flow right (100 cfs) has priority prior to April 1 and is always met by the "with Reclamation". The 100 cfs instream flow water right is also met in April and the 60 cfs water right is met in May at the 50 percent exceedance level. Both modeled scenarios are less than the 60 cfs water right in June at the 50 percent exceedance level.

Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages (during peak downstream migration in May) or critical habitat for coho salmon in mainstem Little Butte Creek.

Antelope Creek

Antelope Creek merges with Little Butte Creek at RM 3.2 downstream from the city of Eagle Point. Most water at Antelope Creek Diversion Dam is diverted in the winter and spring. Hydrology in this stream was not modeled. In the February – June time period, OWRD instream flow water rights for Antelope Creek at the mouth are 25 cfs (February-April), 10 cfs (May), and 5 cfs (June). Operations that result in average monthly flows less than these levels may affect coho fry, juvenile, and smolt life stages.

Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in Antelope Creek.

Emigrant Lake and Emigrant Creek

No ramping rate protocols are required during changes in Emigrant Lake releases. Rapid down ramping may strand small fish and other aquatic organisms in isolated pools. However, a private dam located about one-half mile downstream from Emigrant Dam on Emigrant Creek is a blockage to upstream salmon migration.

Table 5-5 compares “without Reclamation” and “with Reclamation” monthly flows in Emigrant Creek below Emigrant Dam.

From February through June, “with Reclamation” flows are always less than “without Reclamation” flows in this reach. The greatest flow reductions occur in February and March ranging from a reduction of 111 cfs or a 46 percent decrease in a wet March (10 percent exceedance) to a reduction of 7 cfs or a 100 percent decrease in a dry February and March (90 percent exceedence). During drier years, no flow is present with the “with Reclamation” from February through May. This compares with “without Reclamation” conditions where there is always some flow present.

Fish habitat and production in Emigrant Creek immediately downstream from the dam are substantially impacted when releases are terminated. ODFW electrofishing surveys, nonetheless, verify the presence of juvenile salmonids (i.e., steelhead) in this stream reach (Ritchey 2001).

Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in Emigrant Creek.

Bear Creek Streamflows below Ashland Creek

Bear Creek begins 4.5 miles below Emigrant Dam after Emigrant Creek joins Neil Creek. Aquatic habitat conditions in Bear Creek affected by operations include streamflow, water quality, and fish passage. Different streamflow conditions exist when water is diverted during the irrigation season than after irrigation releases stop each year.

Table 5-5 compares "without Reclamation" and "with Reclamation" monthly flows in Bear Creek below Ashland Creek.

Based on modeled results, "with Reclamation" results in major decreases in flow between February and June at this location compared to "without Reclamation" due to Emigrant Lake filling. Most major flow decreases occur during average (50 percent exceedance) and dry (90 percent exceedance) water years. Greatest flow decrease occurs in a normal February with "without Reclamation" flow of 203 cfs compared to "with Reclamation" flow of 100 cfs, a 51 percent decrease. At the 50 percent exceedance level, "with Reclamation" flows between February and June (range from 59 cfs to 146 cfs) would always be below the recommended OWRD instream flows for Bear Creek downstream from Walker Creek. "Without Reclamation" flows would normally be greater than recommended instream flows each month except May and June. The only increase in "with Reclamation" flow occurs in a dry June, with a "with Reclamation" flow of 27 cfs compared to a "without Reclamation" flow of 17 cfs, a 59 percent increase.

These flow effects would likely adversely affect fry, juvenile, and smolt life stages of coho salmon. Fry would likely be displaced into unsuitable habitat and exposed to predation. Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in Bear Creek below Ashland Creek.

Bear Creek Streamflows at Medford

Table 5-5 compares "without Reclamation" and "with Reclamation" monthly flows in Bear Creek at Medford.

The “with Reclamation” results in major decreases in flow between February and June at this location compared to “without Reclamation” due to Emigrant Lake filling. Most major flow decreases occur during average (50 percent exceedance) and dry (90 percent exceedance) water years. Greatest flow decrease occurs in a normal February with “without Reclamation” flow of 259 cfs compared to “with Reclamation” flow of 136 cfs, a 47 percent decrease. At the 50 percent exceedance level, “with Reclamation” flows between February and June (range from 64 cfs to 176 cfs) would always be below the recommended OWRD instream flows for Bear Creek downstream from Walker Creek except for April. “Without Reclamation” flows would exceed recommended instream flows each month except June. The only increase in “with Reclamation” flow occurs in a dry June, with a “with Reclamation” flow of 19 cfs compared with a “without Reclamation” flow of 17 cfs, a 12 percent increase.

These flow effects would likely adversely affect fry, juvenile, and smolt life stages of coho salmon. Fry would likely be displaced into unsuitable habitat and exposed to predation. Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in this reach of Bear Creek.

Bear Creek Streamflows above Jackson Creek

Table 5-6 compares “without Reclamation” and “with Reclamation” monthly flows in Bear Creek above Jackson Creek.

The “with Reclamation” results in major decreases in flow between February and June at this location compared to “without Reclamation”. Most major flow decreases occur during average (50 percent exceedance) and dry (90 percent exceedance) water years. Greatest flow decrease occurs in a dry April with “without Reclamation” flow of 59 cfs compared to “with Reclamation” flow of 19 cfs, a 68 percent decrease. The only increase in “with Reclamation” flow occurs in a dry June, with a “with Reclamation” flow of 19 cfs compared to a “without Reclamation” flow of 1 cfs, an 1800 percent increase. At the 50 percent exceedance level, “with Reclamation” flows between February and June (range from 93 cfs to 174 cfs) would always be below the recommended OWRD instream flows for Bear Creek downstream from Walker Creek except in April. “Without Reclamation” flows would exceed recommended instream flows each month.

These flow effects would likely adversely affect fry, juvenile, and smolt life stages of coho salmon except in an average or dry June when “with Reclamation” would benefit these life stages. Fry would likely be displaced into unsuitable habitat and exposed to predation.

Based on this analysis, the proposed action may affect, and is likely to adversely affect fry, juvenile, and smolt life stages or critical habitat for coho salmon in this reach of Bear Creek.

Irrigation districts, ODFW, and other entities reached an informal agreement in the early 1990s to maintain a year-round 10-cfs minimum flow throughout the length of Bear Creek (ODEQ 2001). The 10-cfs minimum flow has been met most of the time during nonirrigation season at the stream gages downstream from Ashland Creek (RM 20.3) and upstream from Jackson Street Diversion Dam (RM 9.9).

Effects on Young-of-Year Juveniles from July through September

The requirements of juvenile coho salmon during this time period include shallow gravel areas, rearing habitat consisting of a mixture of pools and riffles, instream and bank cover, average water temperatures of 10 °C (50 °F) to 15 °C (59 °F) in the summer, and low amount of fine sediments.

During this time period, Reclamation is releasing natural and stored flows from Howard Prairie Lake, Hyatt Reservoir, and Emigrant Lake into Emigrant and Bear Creeks. Infrequent diversions may occur from the upper tributaries of South Fork Little Butte Creek through Dead Indian and South Fork Little Butte collection canals during this period.

South Fork Little Butte Creek

Table 5-7 compares “without Reclamation” and “with Reclamation” July through September monthly flows in South Fork Little Butte Creek.

Moderate to minor flow changes occur in South Fork Little Butte Creek when comparing “with Reclamation” to “without Reclamation” July through September flows. In general, “with Reclamation” flows are less than or equal to “without Reclamation” flows during this period. Both modeled scenarios are always below the ODWR instream flow rights of 47 cfs for July and August and 38.6 cfs for September at the mouth of South Fork Little Butte Creek.

Warm summertime water temperatures are a major impediment to juvenile survival in South Fork Little Butte Creek. Summer water temperatures in South Fork Little Butte Creek upstream from lower South Fork Diversion Dam (approximately 20 miles) may be adversely affected by Federal diversions since Reclamation diverts an average of 15,500 acre feet of water annually from six diversion structures upstream from lower South Fork Diversion Dam (Vinsonhaler 2002). However, most of the stream exceeds the 64 °F summer ODEQ water temperature standard. Likely causes are natural low flows, some upstream water diversion by non-Federal water users, and lack of riparian shading.

Overall, generally moderate-minor flow decreases compared to "without Reclamation" may affect young-of-the-year juvenile coho during the July – September period as a result of the proposed action. Availability of river edge habitat with appropriate cover elements could becomed limited, which may reduce the value of thermal refugia. Federal water operations are likely to affect water temperatures in some stream reaches, depending on the water year type.

Based on this analysis, the proposed action may affect, and is likely to adversely affect young-of-year juveniles or critical habitat for this life stage of SONCC coho salmon in South Fork Little Butte Creek.

Little Butte Creek

Table 5-7 compares "without Reclamation" and "with Reclamation" July through September monthly flows in Little Butte Creek at Lake Creek.

Little Butte Creek downstream from North Fork and lower South Fork Little Butte Creek Diversion Dams, overall, does not provide good year-round juvenile rearing conditions due to seasonal diversions for irrigation.

Based on modeled results, "with Reclamation" results in major flow increases in average and wet water years compared to "without Reclamation" flows. No flow changes occur during dry water years (90 percent exceedance). Water quality monitoring shows Little Butte Creek retains high summer water temperatures which preclude any meaningful production of juvenile salmonids, except for fall Chinook salmon. Factors elevating water temperature include shallow water conditions, low thermal mass allowing greater heating during the day, and low flow velocity.

Both modeled scenarios exceed OWRD instream flow rights for Little Butte Creek at the mouth in July and August (20 cfs) during average water years, but the flow recommendation of 120 cfs in September is never met by either modeled scenario. Therefore, Little Butte Creek temperatures would still likely exceed the Oregon standard even if the Rogue River Basin Project did not operate.

Senior non-Federal irrigation rights may not allow OWRD summertime instream flow rights to be met downstream from the upper South Fork tributary diversions.

A small, unquantified, portion of irrigated lands drain toward Little Butte Creek. Return flows to the stream are minimal; therefore, water quality impacts related to return flows are minimal (Reclamation 2001b). Overall, young-of-the-year coho salmon or critical habitat should not be affected by operations July through September in Little Butte Creek.

Based on this analysis, the proposed action will have no effect on young-of-year juveniles or critical habitat for this life stage of SONCC coho salmon in the mainstem Little Butte Creek.

Antelope Creek

No summertime diversions occur at Antelope Creek Diversion Dam; therefore, stream water temperatures downstream from this diversion are unaffected by operations. Thus, the proposed action will have no effect on young-of-year juveniles or critical habitat for this life stage of SONCC coho salmon in Antelope Creek.

Bear Creek and Emigrant Creek

Water quality problems in Bear Creek are related to irrigated agriculture, high population density, and community development in Bear Creek watershed.

Table 5-5 and Table 5-6 compare "without Reclamation" and "with Reclamation" monthly flows in Bear Creek at various locations between July and September.

Compared to "without Reclamation" conditions, "with Reclamation" increases summertime flows dramatically in most of the length of Bear Creek (Table 5-5 and Table 5-6). "With Reclamation" flows exceed OWRD flow recommendations for Bear Creek downstream from Walker Creek in August (59 cfs) and September (27 cfs), but are less than flow recommendations in July at the 50 percent exceedance level. Warm water temperatures may preclude juvenile salmonid rearing and survival in most reaches under either scenario.

Storage releases from Emigrant Dam directly influence streamflow which can then affect water quality conditions. Summer fish habitat conditions up and down the length of Bear Creek are likely to be adversely affected by summer/fall irrigation operations even though flows are higher than what occurred prior to Project development. Aquatic macroinvertebrates cannot establish on streambed substrates that are constantly subject to wetting and drying from wide flow fluctuations. Juvenile fish can be stranded in isolated pools when stream reaches rapidly dewater. Past fish surveys found few juvenile coho salmon and steelhead rearing in mainstem Bear Creek. Most habitat conditions in mainstem Bear Creek, except for fall Chinook salmon, appear unfavorable for salmonids, and warm water temperatures are likely a significant major limiting factor for coho salmon and steelhead survival.

Analysis of data collected in Bear Creek and its tributaries has shown substantial summertime exceedence of the Oregon water temperature standard. In general, climatic variables, air temperatures, solar radiation, humidity, and time of year probably have the greatest effect on Bear Creek water temperatures. Additional riparian vegetation restoration is needed to increase summer shading of stream surfaces. Recent Reclamation (2001b) studies show mixed temperature effects, both positive and negative, relative to irrigation return flows to Bear Creek and its tributaries. Federal water operations probably contribute to summertime elevated water temperatures but are not the sole source. Irrigation return flows to Bear Creek, via tributaries, probably have some effect (positive or negative) on the instream temperature in Bear Creek, depending on the tributary, and the relative magnitude of the streamflows in Bear Creek and in the tributary (Reclamation 2001b). That is, if the flow in Bear Creek is high compared to the tributary, then the effect would be insignificant. If the flow in the trbutary is large compared to Bear Creek, then the water temperature would be similar to that of the tributary. The instream temperatures of the tributaries at the confluence with Bear Creek are sometimes higher and, at other times, are lower than the water temperatures in Bear Creek depending on the specific tributary and time period during the summer months.

About 20 tributaries increase Bear Creek flow during nonirrigation season. Water withdrawn from these small streams during irrigation season probably has adverse effects on juvenile fish rearing. Irrigation withdrawals deplete some reaches of these creeks while other sections could have increased flow from irrigation water conveyance. The overall result is reduced quality and quantity of habitat for rearing juvenile fish (e.g., pool quality, thermal refugia).

Based on this analysis, the proposed action may affect, and is likely to adversely affect young-of-year juvenile fish or critical habitat for this life stage of SONCC coho salmon in Emigrant Creek and in mainstem Bear Creek.

Effects on Adult Migration and Spawning from October through February

During this time, the requirements of adult coho salmon include a migratory corridor with suitable water depth and velocities, resting pools, and adequate water quality conditions. Successful migration also depends on adequate fish passage conditions in the main stem river and access to tributaries.

During October, Reclamation is releasing natural and stored flows from Howard Prairie Lake, Hyatt Reservoir, and Emigrant Lake into Emigrant and Bear Creeks. Infrequent diversions may occur from the upper tributaries of South Fork Little Butte Creek through Dead Indian and South Fork Little Butte collection canals during this period.

During November through February, Reclamation is diverting water through Dead Indian and South Fork Little Butte collection canals for storage in Howard Prairie Lake and storing natural flow water in Emigrant Lake.

South Fork Little Butte Creek

Table 5-7 compares “without Reclamation” and “with Reclamation” October through February monthly flows in South Fork Little Butte Creek.

“With Reclamation” streamflows in South Fork Little Butte Creek near Lake Creek would be less than “without Reclamation” from October through February. Greatest precentage decreases would occur during drier years, ranging from a reduction of 3 cfs or 18 percent in October to a reduction of 17 cfs or 41 percent in December at the 90 percent exceedance level. Minor and moderate effects would occur in wet years. Mean “with Reclamation” and “without Reclamation” flows would meet or exceed ODWR instream flow rights in South Fork Little Butte Creek at the mouth in November, December, and January, but would be less than recommended flows in October. Only mean “with Reclamation” flows would be less than recommended flows in February. These recommended flows consider flows necessary to meet depth and velocity criteria for fish passage and spawning. Thus, “with Reclamation” may adversely affect adult coho migrations in South Fork Little Butte Creek in dry water years, particularly in October, primarily because of shallow depths and slow velocities for passage and spawning.

Based on this analysis, the proposed action may affect, and is likely to adversely affect upstream migrating and spawning fish or critical habitat for this life stage of SONCC coho salmon in the South Fork of Little Butte Creek.

Little Butte Creek

Table 5-7 compares “without Reclamation” and “with Reclamation” October through February monthly flows in Little Butte Creek at Lake Creek.

The following discussion refers to the entire mainstem Little Butte Creek below diversions to the mouth of the Rogue River. In general, “with Reclamation” results in increased flows compared to “without Reclamation”, particularly in dry water years.

Major flow increases occur in October and November. Minor flow decreases occur in wet years during November through February. The OWRD instream flow rights for Little Butte Creek at the mouth are exceeded by "with Reclamation" flows November through February in average water years. "With Reclamation" flow of 55 cfs during an average October is less than the recommended flow of 120 cfs for this month. Low fall flow in Little Butte Creek in some dry years, like 2000, may limit upstream migration and spawning of fall Chinook salmon, steelhead, and coho salmon under either modeled scenario. These fish will distribute farther and higher into the watershed in wetter years. No canal stream crossings exist in Little Butte Creek watershed that cause fish passage problems. Compared to "without Reclamation," "with Reclamation" is not likely to adversely affect coho salmon migration and spawning in Little Butte Creek during this period.

Based on this analysis, the proposed action may affect, and is not likely to adversely affect upstream migrating and spawning fish or critical habitat for this life stage of SONCC coho salmon in the Little Butte Creek mainstem.

Antelope Creek

Coho salmon are able to use the lower 6.3 miles of Antelope Creek (Ritchey 2001). Good flow conditions for adult coho salmon migration and spawning are probably of short duration in Antelope Creek. This is a result of diversions at the Antelope Creek Diversion Dam (see Fish Passage section below). This is likely to adversely affect coho salmon migration and spawning.

Diversions during high flows impact adult migrants trying to reach spawning grounds. A minimum 1-cfs flow must be passed at the diversion from November through March. This minimum flows is not likely sufficient to provide adequate instream fish passage. There is no stream gage to record how often these minimum flows occur.

Based on this analysis, the proposed action may affect, and is likely to adversely affect upstream migrating and spawning fish or critical habitat for this life stage of coho salmon in Antelope Creek.

Emigrant Creek and Bear Creek

Table 5-5 and Table 5-6 compare "without Reclamation" and "with Reclamation" monthly flows in Bear Creek at various locations between October and February.

During October, there are major flow increases as a result of the "with Reclamation" throughout Bear Creek. This does not include Emigrant Creek below Emigrant Dam down to Neil Creek. These flow increases are most notable during drier water years. However, between November and February, “with Reclamation” flows are usually less than “without Reclamation” flows throughout Bear Creek. Most major flow decreases occur in January and February due to Emigrant Lake filling and may adversely affect coho adult fish passage into tributaries to spawn. Bear Creek tributaries provide most of the flow to Bear Creek unless flood control management releases are made from Emigrant Lake. As a result, upper Bear Creek flow may not be adequate for salmon and steelhead migration and spawning. In fact, no streamflow resulting from “with Reclamation” occurs in Emigrant Creek below Emigrant Dam during average and dry water years between October and February. The OWRD flow recommendations for Bear Creek downstream from Walker Creek are not met by the “with Reclamation” during average water years from October through February (i.e., Bear Creek below Ashland Creek). These flow recommendations are only met in October at Medford and above Jackson Creek.

There is the potential effect during the spawning/egg incubation period of dewatering of incubating eggs in Bear Creek if flows decline. Hydrologic modeling results indicate under both modeled scenarios flows generally decline between December and March in wet water years. Thus, lower flows resulting from the “with Reclamation” and “without Reclamation” between December and March may result in some dewatering of incubating coho salmon eggs in the mainstem Bear Creek during wet years.

Based on this analysis, the proposed action may affect, and is likely to adversely affect upstream migrating and spawning fish or critical habitat for this life stage of SONCC coho salmon in lower Emigrant Creek and in mainstem Bear Creek.

Fish Passage

Little Butte Creek Watershed

Federal Facilities

Adult fish passage facilities at Antelope Creek Diversion Dam were totally upgraded in 1997-1998. Adult passage is provided by a pool and weir facility.

Water is diverted in winter and spring during these higher flow periods and, as a result, probably affects opportunistic spawner migration in stream reaches downstream from the diversion. Diversions during high flows inhibit passage of adult migrants trying to reach spawning grounds. Likewise, higher flows for spring smolt migration are limited as water can also be withdrawn at this time. A minimum 1-cfs flow must be passed at the diversion from November through March and 2 cfs the rest of the year. These minimum flows are unlikely sufficient to provide adequate instream fish passage. There is no stream gage to record how often these minimum flows occur.

Bear Creek Watershed

Federal Facilities

Juvenile fish passage at the Oak Street and Phoenix Canal diversion dams was modified in the late 1990s to meet NMFS design and criteria. Most canals cross Bear Creek's fish-bearing tributaries by buried siphons or overhead flumes (Ashland, East, West, Talent, and Hopkins Canal) and cause no fish passage delays.

The Phoenix Canal (interrelated and interdependent facility) traverses Coleman and Griffin Creeks using temporary diversion check dams that block passage to migrating fish. Stoplog boards are installed during irrigation season to divert the stream to the canal. The structures may waste some water to meet downstream diversion rights.

No fish passage provisions currently exist at these structures. Downstream migrant smolt or juvenile fish would be forced to enter the Phoenix Canal and will likely be lost to the system.

Juvenile fish passage at Jackson Street Diversion Dam (interrelated and interdependent facility) was modified in the late 1990s to meet NMFS design and criteria.

6.2.2 Klamath River Basin

Hydrology and Summer Water Temperature Approach

The proposed action affects the Klamath River basin due to diversions from Jenny Creek in the Klamath River basin which enter the Rogue River basin.

The Klamath River basin analyses were developed from modeled hydrologic and water quality data originally presented in the February 25, 2002, Klamath BA and modified to represent "with Reclamation" as directed by the 2002 Biological Opinion on the Klamath BA.

"With Reclamation" flows were compared with "without Reclamation" flows to assess effects on coho salmon. Iron Gate Dam forms a permanent fish passage barrier to any further migration upstream in the Klamath River.

The KPOPSIM Hydrology Model was used to simulate “without Reclamation” and “with Reclamation” stream flows in the Klamath River basin. The “with Reclamation” scenario was based on Klamath Project operations proposed for 2003, including a 50 TAF “water bank” for Iron Gate Dam flows. The comparison of the “with Reclamation” to the “without Reclamation” demonstrates the effects of keeping Jenny Creek flows in the Klamath River basin.

Jenny Creek is a tributary to the Klamath River above Iron Gate Reservoir and drains approximately 205 square miles before entering Iron Gate Reservoir. For the Klamath River basin “without Reclamation”, Jenny Creek water values were simulated as additional flow gains (Table 6-1) to the Klamath Project KPOPSIM model for water years 1961 through 2001. For the Rogue River Basin Project, this was interpreted as monthly distribution of computed annual Jenny Creek contributions to the Rogue River basin. As a result of the Rogue River Basin Project transbasin diversion, Jenny Creek was determined to contribute, on average, 24,230 acre-feet per water year to the Rogue River basin. Pre-Klamath Project estimated average annual flow at Iron Gate for a normal water year, which accounts for accretions in flow below Keno, was approximately 1.8 million acre-feet (Balance Hydrologics, Inc. 1996). Thus, Jenny Creek contributes approximately 1.3 percent of the total water balance in the upper Klamath River basin.

As a result of the “with Reclamation,” flows in the mainstem Klamath River will be slightly affected by releases from Iron Gate Dam (Table 6-2). This is illustrated by comparing the “with Reclamation” flows in the Klamath River downstream from Iron Gate Dam to the “without Reclamation” flows (Jenny Creek inflows) for each water year type (figures 6-1 through 6-10). These “with Reclamation” flows were compared to “without Reclamation” operation flows to assess effects on coho salmon.

Table 6-1. Jenny Creek Flow Gains into Klamath River Basin (cfs)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
1961	5	6	19	30	75	117	117	137	137	50	50	14	14	7	7	4	4
1962	2	3	8	13	33	51	51	59	59	22	22	6	6	3	3	2	2
1963	2	3	10	16	39	61	61	72	72	26	26	7	7	4	4	2	2
1964	4	6	18	28	70	110	110	128	128	47	47	13	13	6	6	4	4
1965	5	7	21	33	81	126	126	148	148	54	54	15	15	7	7	5	5
1966	5	6	19	30	75	117	117	137	137	50	50	14	14	7	7	4	4
1967	3	4	11	17	42	65	65	77	77	28	28	8	8	4	4	2	2
1968	5	8	23	37	91	142	142	167	167	61	61	17	17	8	8	5	5
1969	2	3	8	12	30	46	46	54	54	20	20	6	6	3	3	2	2
1970	3	5	14	23	56	88	88	103	103	37	37	11	11	5	5	3	3
1971	4	5	15	24	60	94	94	110	110	40	40	11	11	5	5	3	3
1972	4	6	17	27	68	106	106	124	124	45	45	13	13	6	6	4	4
1973	4	6	19	30	73	114	114	133	133	49	49	14	14	7	7	4	4
1974	3	5	14	23	56	88	88	102	102	37	37	11	11	5	5	3	3
1975	4	6	19	30	75	116	116	136	136	50	50	14	14	7	7	4	4
1976	4	6	17	27	67	104	104	122	122	44	44	13	13	6	6	4	4
1977	5	8	23	37	91	142	142	166	166	60	60	17	17	8	8	5	5
1978	2	3	7	12	29	45	45	53	53	19	19	6	6	3	3	2	2
1979	2	4	11	17	41	64	64	75	75	27	27	8	8	4	4	2	2

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
1980	4	6	16	26	64	100	100	117	117	43	43	12	12	6	6	4	4
1981	5	7	20	32	80	124	124	145	145	53	53	15	15	7	7	5	5
1982	4	6	17	26	66	102	102	120	120	44	44	12	12	6	6	4	4
1983	5	8	23	36	90	141	141	165	165	60	60	17	17	8	8	5	5
1984	6	8	24	38	94	146	146	171	171	62	62	18	18	8	8	5	5
1985	5	8	23	36	88	137	137	161	161	59	59	17	17	8	8	5	5
1986	6	8	25	39	96	150	150	175	175	64	64	18	18	9	9	6	6
1987	7	9	28	44	110	171	171	201	201	73	73	21	21	10	10	6	6
1988	7	10	29	46	113	177	177	207	207	75	75	21	21	10	10	6	6
1989	3	4	11	17	43	67	67	78	78	29	29	8	8	4	4	2	2
1990	3	4	11	18	44	68	68	79	79	29	29	8	8	4	4	2	2
1991	3	4	11	17	42	65	65	76	76	28	28	8	8	4	4	2	2
1992	4	6	19	30	74	115	115	135	135	49	49	14	14	7	7	4	4
1993	0	0	1	1	3	4	4	5	5	2	2	1	1	0	0	0	0
1994	5	7	22	35	87	135	135	158	158	57	57	16	16	8	8	5	5
1995	0	0	0	0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0
1996	6	8	24	37	92	144	144	168	168	61	61	17	17	8	8	5	5
1997	6	8	24	37	93	144	144	169	169	61	61	18	18	8	8	5	5
1998	2	3	8	13	31	49	49	57	57	21	21	6	6	3	3	2	2
1999	2	3	8	13	33	52	52	60	60	22	22	6	6	3	3	2	2

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
2000	6	8	24	37	92	144	144	168	168	61	61	17	17	8	8	5	5
2001	4	6	18	28	70	110	110	128	128	47	47	13	13	6	6	4	4
AVG	4	6	17	26	65	101	101	118	118	43	43	12	12	6	6	4	4

Table 6-2. Percent Changes in Flows at Iron Gate Dam in the Klamath River with Jenny Creek Contributions (cfs)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
1961	0.3	0.2	0.8	2.0	2.9	3.9	5.9	6.8	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	1.9	0.1	0.4	0.9	1.4	2.2	2.4	1.9	1.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.3	0.1	0.3	0.5	2.5	2.8	2.7	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.7	0.3	1.2	1.2	3.2	6.0	6.1	4.2	4.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	1.8	0.2	0.4	1.2	3.0	3.0	5.5	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	1.8	0.2	1.0	1.3	3.5	5.1	4.4	4.7	3.4	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	1.3	0.4	0.0	1.3	2.3	2.2	0.0	0.2	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0
1968	1.2	0.5	1.6	2.0	2.8	5.0	4.9	0.0	2.0	3.7	4.7	0.0	0.0	0.0	0.0	0.0	0.0
1969	0.0	0.0	0.0	1.3	1.1	1.5	1.4	1.0	1.0	0.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0
1970	0.7	0.3	0.5	0.3	1.4	2.7	2.7	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.7	0.5	0.5	1.9	1.8	1.8	1.8	1.8	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.7	0.2	0.7	0.9	1.3	1.0	1.0	3.2	3.2	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.8	0.3	0.7	1.0	2.5	5.6	2.8	0.1	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
1974	0.0	0.6	0.4	0.4	1.7	1.6	1.6	1.6	1.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975	0.7	0.3	0.9	1.1	2.1	3.0	2.4	3.2	3.2	1.2	1.4	0.0	1.8	0.0	0.0	0.0	0.0
1976	0.4	0.2	0.7	1.0	2.2	4.6	4.1	5.1	0.6	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977	0.7	0.3	0.0	2.2	7.4	15.0	19.0	18.9	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978	0.0	0.0	0.6	0.6	0.9	1.3	1.3	1.5	1.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
1979	0.4	0.0	0.7	0.7	1.7	2.8	3.3	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	1.0	0.8	0.6	1.9	4.2	4.2	5.7	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	5.6	4.7	7.2	7.5	11.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	0.0	1.5	0.3	0.9	0.8	1.8	1.8	2.1	2.1	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.8	0.3	0.8	1.3	1.5	1.9	1.9	2.9	2.9	0.0	1.6	0.0	1.5	0.0	0.0	0.0	0.0
1984	0.6	0.2	0.4	1.0	1.4	2.4	2.4	3.2	3.2	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.9	0.2	0.9	1.6	3.7	4.3	4.3	3.7	3.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.4	0.4	1.2	1.2	1.3	2.2	2.2	6.0	6.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.9	0.5	1.3	2.0	3.7	7.6	7.7	6.8	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	3.2	1.3	2.2	1.8	7.8	15.6	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	7.7	1.0	1.1	1.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.4	0.2	0.8	0.8	2.1	2.5	3.3	0.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	5.8	6.6	18.5	6.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	26.3	14.6	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.3	0.6	1.7	0.0	10.6	12.8	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.6	0.8	0.9	1.0	3.1	3.1	4.8	4.8	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
1997	1.9	0.3	0.5	0.6	1.8	5.1	5.1	7.7	1.1	2.3	0.0	1.2	1.2	0.0	0.0	0.0	0.0

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Sep
1998	0.8	0.1	0.4	0.3	0.8	1.0	1.0	1.4	1.4	0.4	0.4	0.2	0.2	0.0	0.0	0.0	0.0
1999	0.3	0.1	0.3	0.4	0.7	0.8	0.8	0.0	0.5	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.7	0.4	0.2	1.2	2.4	4.5	4.5	6.4	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.4	0.4	1.2	1.9	8.6	9.1	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG	0.5	0.4	0.6	1.0	3.2	4.2	4.7	3.2	3.0	0.7	0.6	0.1	0.1	0.0	0.0	0.0	0.0

The water quality temperature analysis looked at the Klamath River from Iron Gate Dam to Seiad Valley. The method used to determine the effects of proposed water delivery and storage on threatened coho salmon in the mainstem Klamath River was to compare flows as modeled at Iron Gate Dam resulting from the "with Reclamation" and the "without Reclamation" flow releases in the mid-June to September period when high water temperatures and low dissolved oxygen levels create an unfavorable environment for salmon. Effects of summer Klamath River flows on water temperature were determined from RMA-11 model simulations (Deas and Orlob 1999). Although river flow can directly impact water temperatures in Klamath River (Deas 2000), there is a lack of data demonstrating a clear association between changes in Klamath River flow and health of coho salmon.

Figure 6-1 through Figure 6-5 illustrate flows as measured at Iron Gate Dam with the "with Reclamation" and "without Reclamation" flows for coho salmon for each water year type. Figure 6-6 through Figure 6-10 compare "with Reclamation" and "without Reclamation" conditions Klamath River simulated flows between Shasta River and Scott River confluences for each water year type.

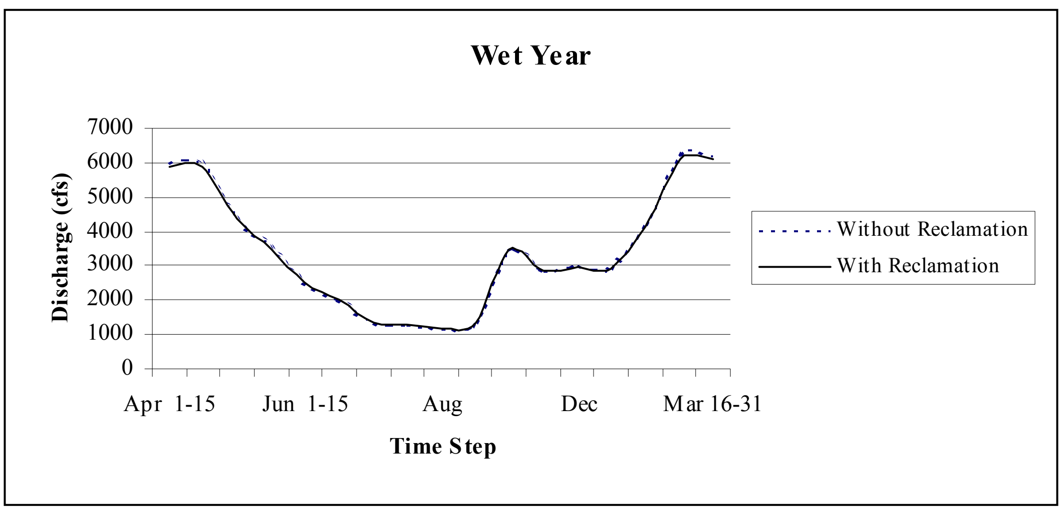

Figure 6-1. Iron Gate Dam flows during "wet" water year type under "with Reclamation" and "without Reclamation" conditions.

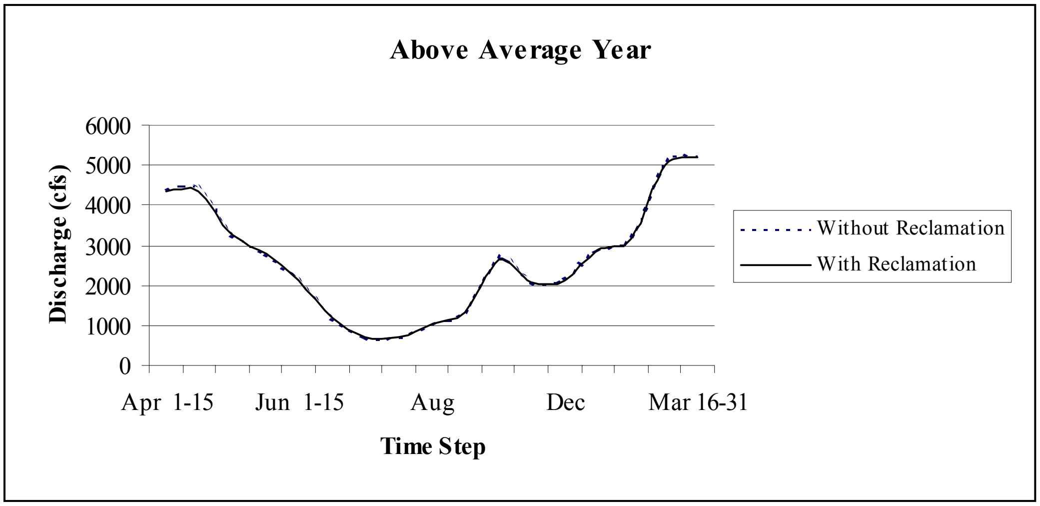

Figure 6-2. Iron Gate Dam flows during "above average" water year type under "with Reclamation" and "without Reclamation" conditions.

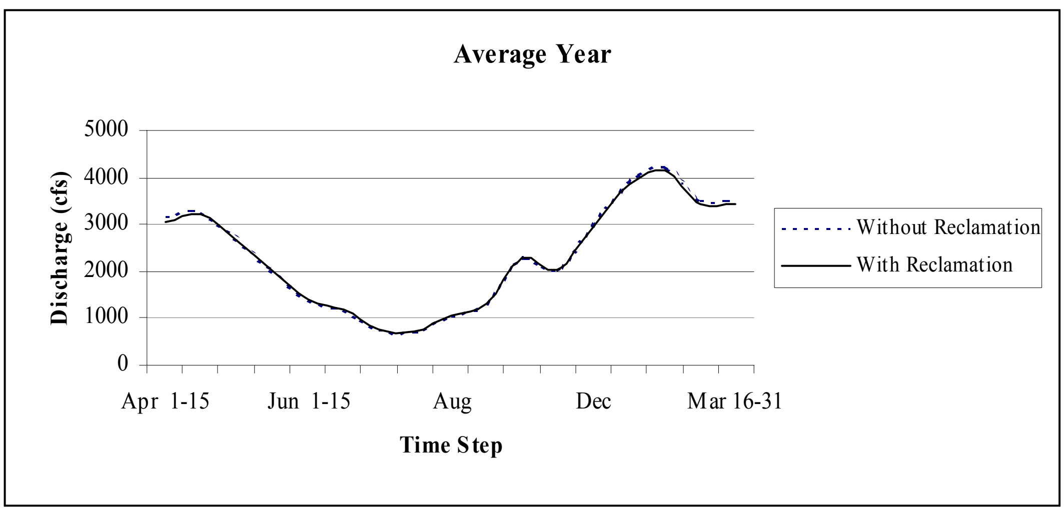

Figure 6-3. Iron Gate Dam flows during "average" water year type under "with Reclamation" and "without Reclamation" conditions.

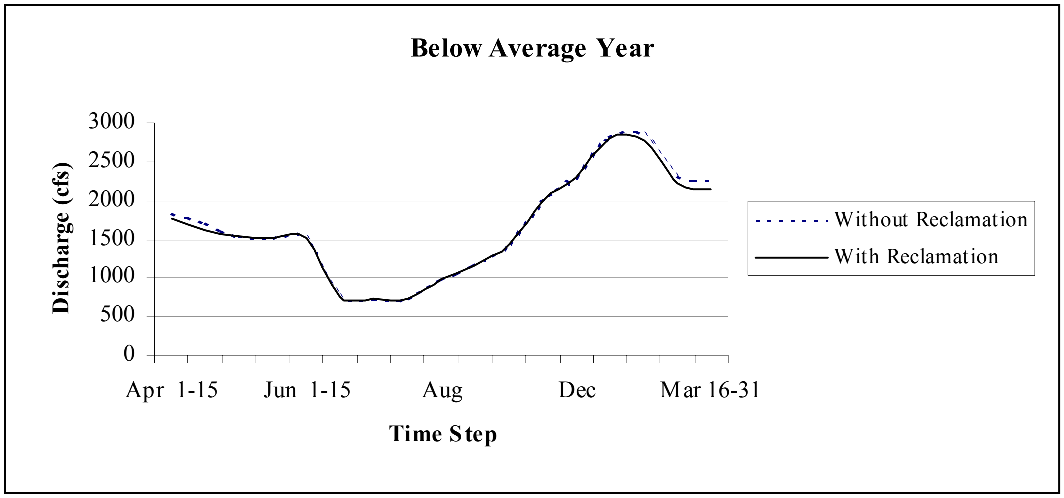

Figure 6-4. Iron Gate Dam flows during "below average" water year type under "with Reclamation" and "without Reclamation" conditions.

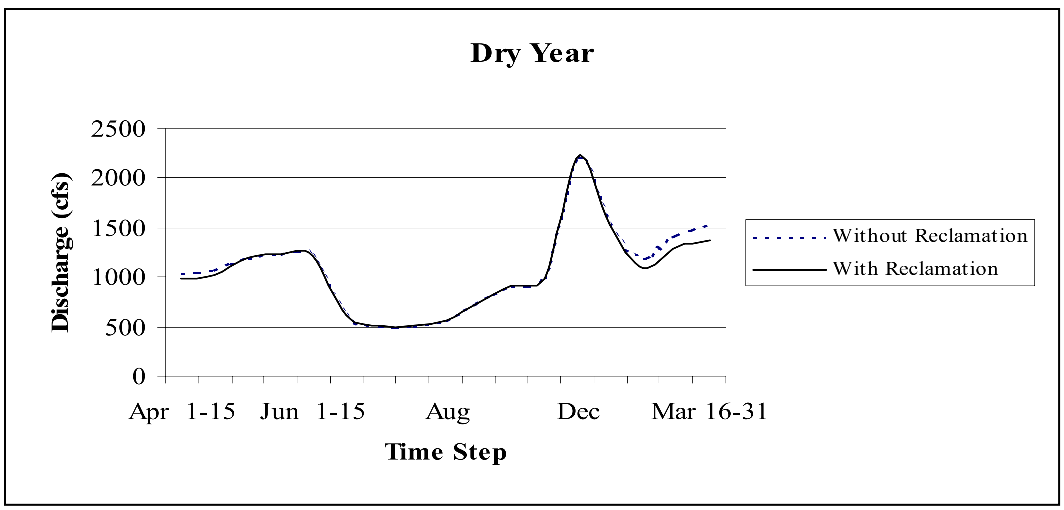

Figure 6-5. Iron Gate Dam flows during "dry" water year type under "with Reclamation" and "without Reclamation" conditions.

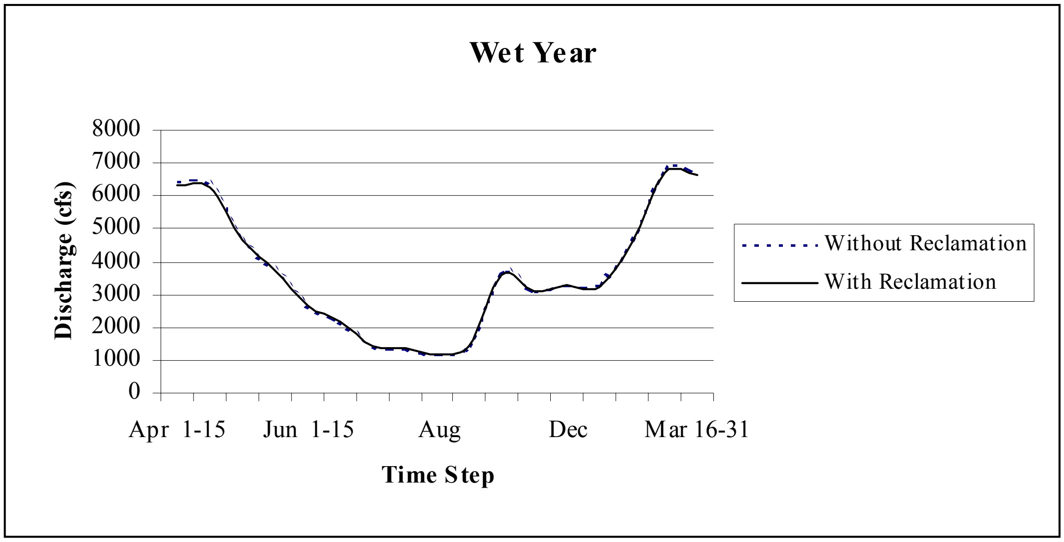

Figure 6-6. Klamath River flows between Shasta River and Scott River confluences during “wet” water year type under “with Reclamation” and “without Reclamation” conditions.

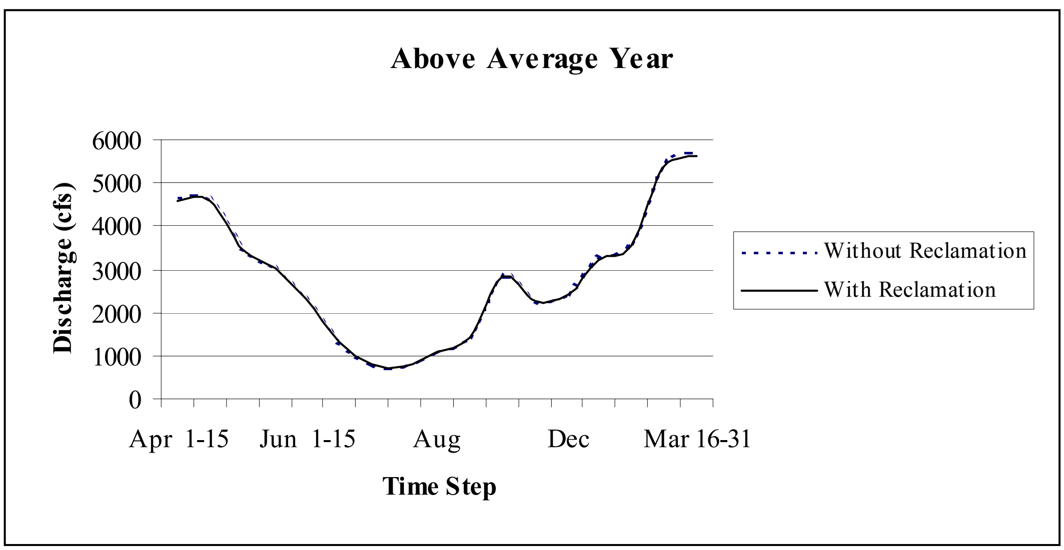

Figure 6-7. Klamath River flows between Shasta River and Scott River confluences during “above average” water year type under “with Reclamation” and “without Reclamation” conditions.

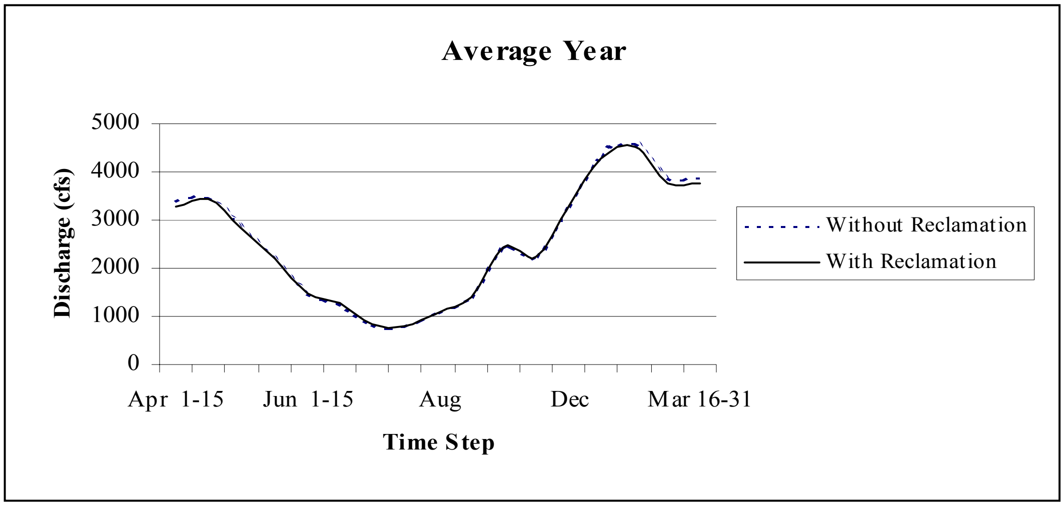

Figure 6-8. Klamath River flows between Shasta River and Scott River confluences during "average" water year type under "with Reclamation" and "without Reclamation" conditions.

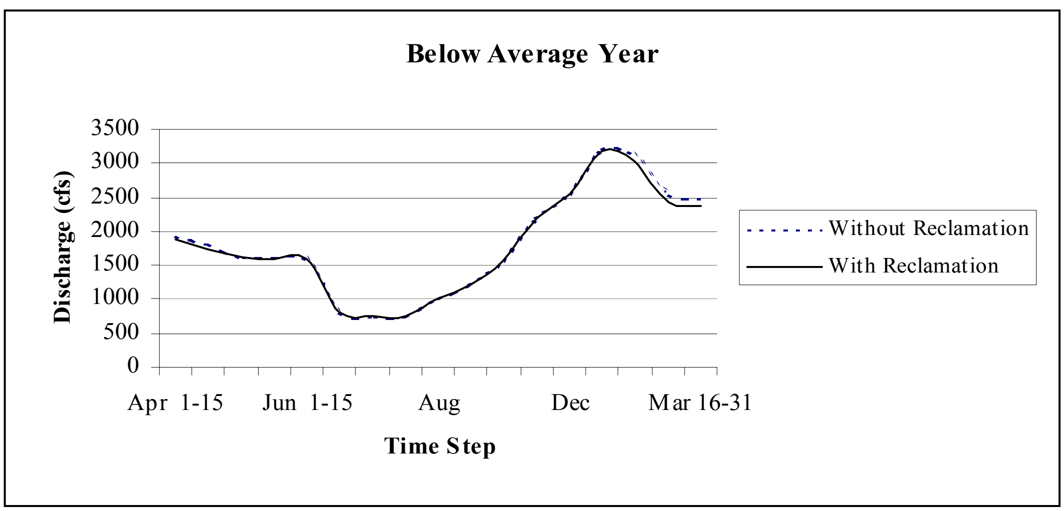

Figure 6-9. Klamath River flows between Shasta River and Scott River confluences during "below average" water year type under "with Reclamation" and "without Reclamation" conditions.

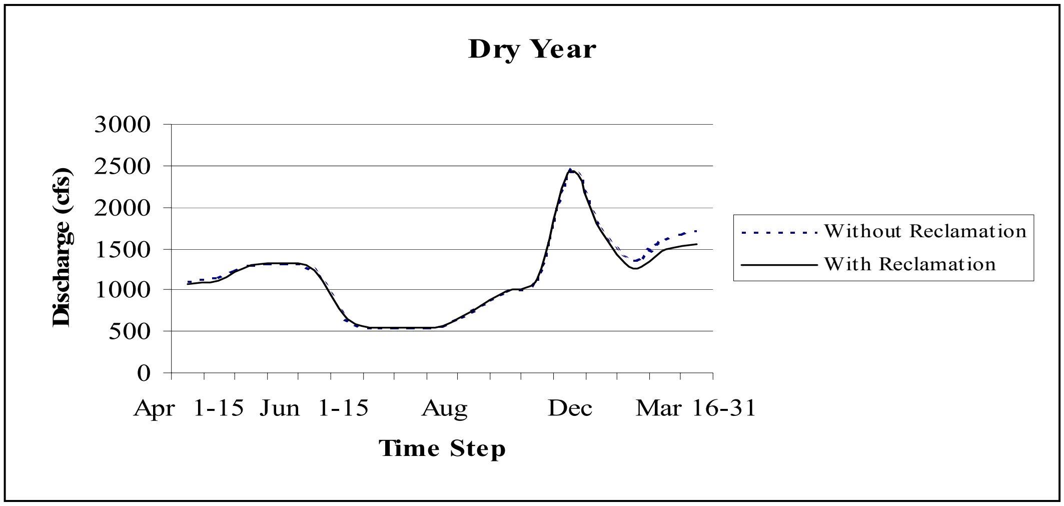

Figure 6-10. Klamath River flows between Shasta River and Scott River confluences during "dry" water year type under "with Reclamation" and "without Reclamation" conditions.

Habitat Approach

The habitat analysis study area included the Klamath River from Iron Gate Dam downstream to the confluence with Scott River. The habitat analysis was based on the periodicity of fry and spawning life stages of coho salmon in the Klamath River. Coho salmon fry occur in mainstem Klamath River from February to June (Hardy and Addley 2001). Most spawning occurs from November to January (Hassler 1987). The underlying assumption for the habitat analysis is that suitable macrohabitat (channel characteristics, water quality, and water temperature) occurs throughout the river reach for coho salmon.

Habitat versus flow relationships for anadromous fishes in the Klamath River mainstem were developed by Hardy and Addley (2001). The general assumption underlying habitat modeling is that aquatic species will react to changes in the hydraulic environment (Hardy and Addley 2001). In general, the relationship between flow and habitat starts at the origin (no flow, no habitat), increases (not necessarily in a uniform manner) with flow up to a point, and then declines if flows become excessive. These "habitat versus flow" relationships were developed by first determining the hydraulic characteristics (e.g., depth and velocity) of the Klamath River mainstem channel between Iron Gate Dam and the Shasta River confluence and between Shasta River and Scott River as a function of discharge. This information was then integrated with habitat suitability criteria to produce a measure of available habitat (percent of optimal habitat) as a function of discharge (Hardy and Addley 2001). Habitat suitability criteria describe biological responses of target species and life stages to the hydraulic environment (i.e., how suitable a particular gradient of depth, velocity, substrate, cover, etc., is to a target species and life stage). For example, habitat suitability as a function of depth is represented on a scale of 0.0 to 1.0. A suitability value of 0.0 represents a depth that is wholly not suitable, while a 1.0 value indicates a depth that is "ideally" suitable. Figure 6-11 and Figure 6-12 are graphic representations of the data in Table 6-3 and Table 6-4. Specific relationships between the status of salmon and Klamath River flow amounts have not been established.

Table 6-3. Habitat-discharge relationships for salmon in Klamath River (Iron Gate Dam-Shasta River)

Discharge (cfs)	Percent of optimal habitat	
	Chinook spawn	Coho fry
500	66	59
713	81	46
927	91	44
1140	97	44
1393	100	47
1647	100	48
1900	97	51
2191	90	58
2482	82	65

Discharge (cfs)	Percent of optimal habitat	
	Chinook spawn	Coho fry
2773	74	71
3064	65	76
3365	57	81
4086	40	91
4817	28	97
5548	21	100
6365	16	89
7183	13	85
8000	12	81

Source: Hardy and Addley (2001)

Table 6-4. Habitat-discharge relationships for salmon in Klamath River

Discharge (cfs)	Percent of Optimal Habitat	
	Chinook spawn	Coho fry
912	100	18
1224	97	22
1629	88	30
2034	77	36
2671	65	54
3309	57	68
3946	52	79
4584	48	89
5221	45	96
5858	43	100
6496	41	95
7332	40	87
8169	38	78
9005	36	68

Source: Hardy and Addley (2001)

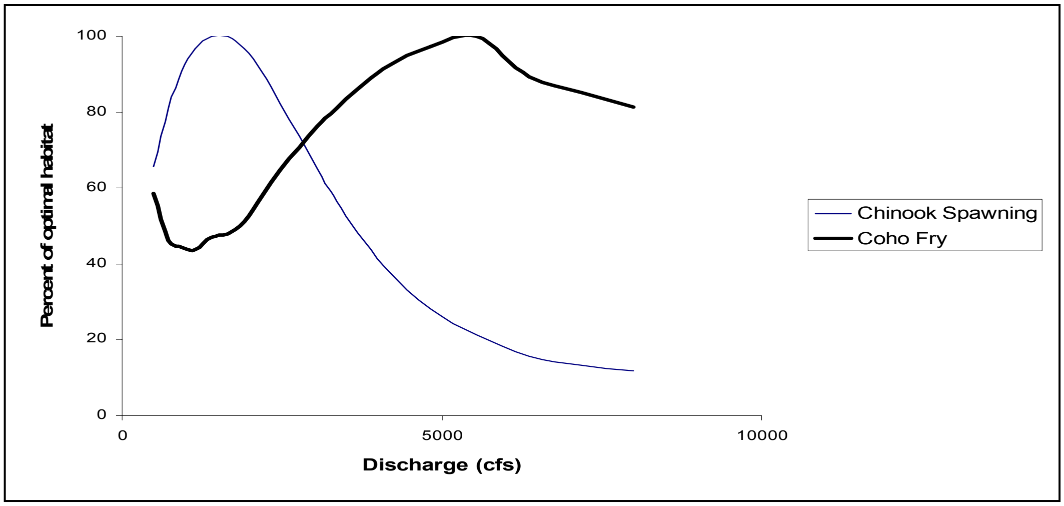

Figure 6-11 . Habitat discharge relationships for coho fry and Chinook spawning in Klamath River, Iron Gate Dam to Shasta River (Hardy and Addley 2001).

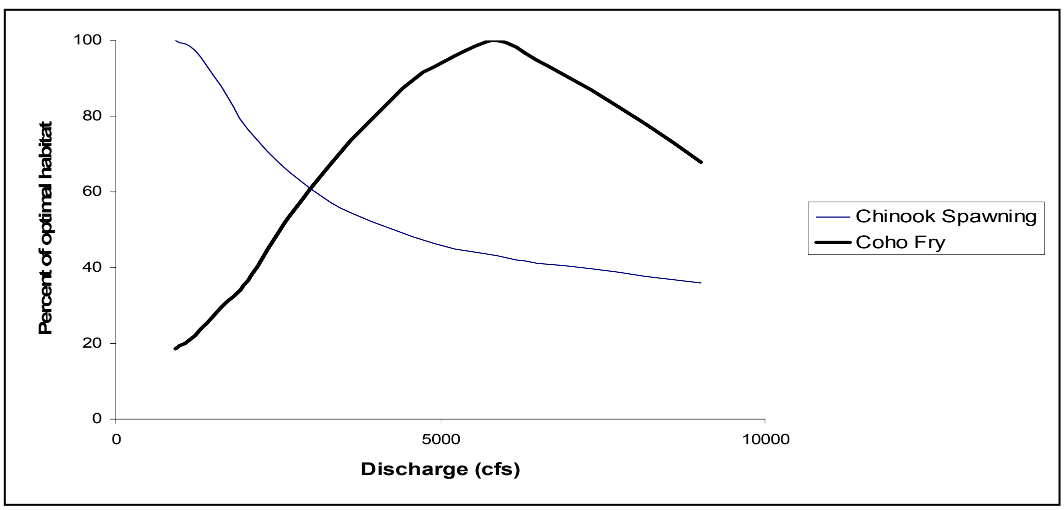

Figure 6-12. Habitat - discharge relationships for coho fry and Chinook spawning in Klamath River, Shasta River-Scott River. Source: Hardy and Addley (2001)

The following approach was used to determine the effects of the proposed action on coho salmon habitat in the Klamath River. The Klamath mainstem "without Reclamation" flows and flows resulting from the "with Reclamation" (Figure 6-6 through Figure 6-10) were integrated with the preliminary Iron Gate Dam to Shasta River and Shasta River to Scott River habitat (percent of optimal habitat) versus discharge (cfs) relationships from the Hardy and Addley (2001) study for coho fry and Chinook spawning life stages (Table 6-3 and Table 6-4; Figure 6-11 and Figure 6-12) to construct two sets of habitat values ("with Reclamation" and "without Reclamation" scenarios). There is no available information on the relationship between Klamath River flows and coho salmon spawning habitat. However, since fall Chinook salmon utilize the mainstem Klamath River for spawning during the same period that coho salmon spawn (INSE 1999), Chinook spawning was considered the best surrogate life stage for coho migration and spawning.

These life stages were considered the highest priority for the following time periods:

- Coho fry from February - June 15
- Coho/Chinook spawning from October - February

The impact assessment for coho fry was determined based on the percentage difference between the habitat values "with Reclamation" and "without Reclamation." For purposes of this analysis, habitat effects due to the "with Reclamation," as a percentage of "without Reclamation", were considered minor if less than or equal to 10 percent; moderate between 11-20 percent; and major more than 20 percent. The rationale for these percentages is similar to that used by NMFS (2002). In their analysis, they assumed potential errors of 10 percent associated with stream gaging estimates and stream habitat modeling. Percent changes greater than 10 percent would more likely reflect actual habitat changes. In addition, NMFS (2002) felt that fry habitat should not be reduced by more than 20 percent of baseline conditions as a long-term target. For this BA, a similar analysis was done for Chinook salmon spawning to assess effects on spawning and egg incubation habitat in the fall and winter.

Effects of Flow on Fry, Juvenile, and Smolt Life Stages from February through June

Reclamation is storing water, delivering stored water and diverting inflow during this period. Water delivery for Klamath Project purposes includes delivery of water from Upper Klamath Lake storage and diversion of water from net inflows into Upper Klamath Lake. The delivery of water from Upper Klamath Lake storage does not adversely affect "without Reclamation" conditions on the Klamath River below Iron

Gate Dam. Thus, any adverse effects in the following analysis are attributable to diversion of water from net inflows only. Also, conclusions based on the following analyses recognize the lack of data demonstrating relationships between changes in Klamath River flow and coho survival.

Minor decreases (less than 10 percent) in fry habitat occur “with Reclamation” compared to “without Reclamation” in all water years (Table 6-5 and Table 6-6). Habitat losses range from –0.1 percent in May 16-31 of below average years between Iron Gate Dam and Shasta River and June 1-15 of average and below average years between Shasta River and Scott River to –8.9 percent in March 16-31 of dry years. Coho fry would probably not be affected by decreased carrying capacity and displacement of fry into less suitable habitat as a result of these minor habitat losses which exist within model error. As a result, survival of salmon fry should not be affected.

Based on this analysis, the proposed action may affect, but not likely to adversely affect fry life stage or critical habitat for coho salmon in the Klamath River.

Table 6-5. Coho fry habitat (percent optimal habitat) in Klamath River between Iron Gate Dam and Shasta River confluence. "Without Reclamation" compared to "with Reclamation".

	Wet			Above Average			Average			Below Average			Dry		
Time Step	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change
February	92.3	91.9	-0.5	78.9	78.2	-0.9	92.6	92.1	-0.6	72.0	70.7	-1.8	44.4	43.9	-1.0
March 1-15	91.3	92.7	1.5	98.3	98.0	-0.3	83.5	82.0	-1.8	61.2	58.6	-4.3	47.1	45.8	-2.7
March 16-31	91.6	92.9	1.5	98.9	98.7	-0.3	83.7	82.2	-1.8	59.9	56.9	-5.0	47.4	46.8	-1.4
April 1-15	93.9	95.3	1.5	93.9	93.3	-0.6	78.1	76.1	-2.6	50.2	49.5	-1.4	44.1	44.2	0.3
April 16-30	94.2	95.7	1.6	94.1	93.6	-0.5	79.8	78.6	-1.5	48.6	47.7	-1.8	44.0	44.1	0.3
May 1-15	93.8	93.7	-0.2	79.7	79.5	-0.3	69.7	68.8	-1.2	47.4	47.4	0.0	44.6	44.6	0.0
May 16-31	83.3	82.8	-0.6	71.4	70.9	-0.7	54.5	54.4	-0.2	47.4	47.3	-0.1	45.0	45.0	0.0
June 1-15	65.5	65.5	0.0	56.9	56.9	0.0	47.0	47.0	0.0	47.4	47.4	0.0	44.6	44.6	0.0

Table 6-6 Coho fry habitat (percent optimal habitat) in Klamath River between Shasta River and Scott River confluences. "Without Reclamation" compared to "with Reclamation".

	Wet			Above Average			Average			Below Average			Dry		
Time Step	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change
February	90.4	89.8	-0.7	72.6	71.8	-1.1	89.6	88.6	-1.1	63.3	61.8	-2.4	24.9	22.9	-7.9
March 1-15	91.8	92.8	1.0	97.6	97.1	-0.5	77.7	75.8	-2.4	50.2	47.2	-6.0	29.4	27.1	-7.9
March 16 -31	92.3	93.2	1.0	99.0	98.6	-0.4	77.6	75.7	-2.4	48.7	45.3	-7.0	31.2	28.4	-8.9
April 1-15	95.2	96.1	1.0	90.3	89.5	-0.8	69.1	66.7	-3.5	34.8	33.9	-2.6	31.2	30.6	-1.7
April 16-30	95.4	96.4	1.0	90.2	89.5	-0.7	71.1	69.7	-1.9	32.7	31.3	-4.4	31.6	31.1	-1.6
May 1-15	90.1	89.9	-0.2	70.8	70.5	-0.3	57.8	57.0	-1.5	29.6	29.5	-0.3	23.5	23.5	0.0
May 16 - 31	76.0	75.3	-0.9	61.5	60.9	-1.0	40.6	40.5	-0.3	29.3	29.1	-0.8	24.0	24.0	0.0
June 1-15	54.1	54.1	0.0	44.4	44.3	0.0	27.3	27.2	-0.1	29.0	28.9	-0.1	22.6	22.6	0.0

Effects on Young-of-the-Year Juveniles from July through September

Bartholow (1995) reviewed available data on temperature effects on anadromous species in the Klamath River and found that the mainstem Klamath experiences elevated temperatures deleterious to salmonids for much of the summer and early fall period. As described by Campbell (1995), increased water temperatures and lower saturated oxygen concentrations typically occur in the Klamath River during summer months, the same time of year that the growth and respiration cycles of aquatic plants affect dissolved oxygen concentration. Thus, water temperatures and water quality in mainstem Klamath River contribute to unfavorable environmental conditions for juvenile salmon during the summer (late June-September).

River flow can directly impact water temperatures in the Klamath River (Deas 2000). Flow and temperature simulations using the RMA-11 model in the sixty-mile reach from Iron Gate Dam to Seiad Valley suggest that during summer periods lower flows, as explained below, generally lead to slightly higher downstream temperatures (Table 6-7). Simulated temperature response for a typical mid-summer day at various Iron Gate Dam flows illustrates the flow-temperature interdependence. At 500 cfs, simulated daily mean water temperature increases 2.5 ^{o}C (4.9 ^{o}F) over the 60-mile reach from Iron Gate Dam to Seiad Valley, while at 3,000 cfs the simulated increase is roughly 0.9 ^{o}C (1.6 ^{o}F) (Table 6-7) (Deas 2000; Deas and Orlob 1999). Water temperatures are elevated at low flow rates because of an increase in transit time, less thermal mass allowing greater heating during the day, and shallower river conditions. At 500 cfs, a mean simulated temperature of approximately 25 ^{o}C (77 °F) was recorded at Seiad Valley, compared to about 23 ^{o}C (73.4 °F) at 3,000 cfs in mid-August (Deas 2000; Deas and Orlob 1999). Thus, high water temperatures can occur at high and low flows, depending on climatic conditions. The extent to which operations affect water temperature is complex and remains unclear (Hecht and Kamman 1996).

The NRC (2002) did not find any scientific support for proposed minimum Iron Gate Dam flows as a means of enhancing the maintenance and recovery of the coho salmon population in the reasonable and prudent alternative issued in NMFS's (2001) BO. The NRC (2002) suggested that higher flows from July through September may actually harm coho salmon if the source is warmer than the receiving water. The NRC (2002) strongly encouraged that additional rigorous studies be conducted to address this issue. Also, increased flows may have a detrimental effect on the availability of thermal refugia created by groundwater seepage and small tributary flows (NRC 2002). Increased flows may reduce the size of these refugia by causing more effective mixing of small amounts of locally derived cool water with much larger amounts of warm water from upstream (NRC 2002). The NRC (2002) also noted, however, that progressive depletion of flows in the Klamath River mainstem would at some point be detrimental to coho salmon through stranding or predation losses. They concluded that there is no scientific justification at present for deviating from flows derived from operational practices in place for the period 1990 – 1999 (NRC 2002).

Young-of-the-year survival, growth, and recruitment depend on the availability of total habitat, including suitable macrohabitat (water quality and temperature) and suitable microhabitat (depth, velocity, and cover) conditions under different river flows. There is a lack of data demonstrating a clear association between changes in Klamath River flow and habitat and the status of the salmon. The availability of suitable microhabitat may not be a primary factor in the survival of young-of-the-year salmonids when acute water temperatures prevail. Chronic (>15 ^{o}C or 59 ° F) and acute (>20 ^{o}C or 68 °F) water temperatures for salmonids in the Klamath River are based on an evaluation of existing published information on observed relationships between water temperature and Chinook salmon tolerances (Bartholow 1995). These “thresholds” may create a population bottleneck by impacting young-of-the-year and juvenile coho in late July and August. The fact that juvenile salmonids persist in the Klamath River mainstem despite temperatures that generally exceed these chronic and acute temperature thresholds (Yurok Tribal Fisheries Program 1999, 2000) illustrates the complexity of this issue.

Temperature has direct effects on physical, chemical, and biological processes in most aquatic systems. High temperatures increase chemical reactions, metabolic rates, and decrease the solubility of gases such as oxygen, carbon dioxide and nitrogen (Deas 2000). Excessive water temperature can reduce productivity and increase mortality of aquatic organisms. Temperature affects fish physiology, specifically respiration, food intake, digestion, assimilation, and behavior.

Bartholow (1995) found no data supporting the contention that Klamath River salmonid stocks were more thermally tolerant than other west coast stocks. In fact, the small amount of information available indicates no difference (Bartholow 1995). However, there is evidence that juvenile Chinook and coho salmon and steelhead persist in the Klamath River mainstem despite temperatures that generally exceed the chronic and acute temperature thresholds (Belchik 2000). Studies by Konecki et al. (1995) of juvenile coho salmon near St. Helens, Washington, found juvenile coho could tolerate water temperatures exceeding 24 ^{o}C (75.2 ^{o}F) and in some cases were observed in streams with temperatures as high as 29 ^{o}C (84.2 ^{o}F).

Klamath River flows greater than those resulting from the Rogue River basin proposed action downstream from Iron Gate Dam from July through September will not likely reduce mean water temperature to levels below chronic and acute levels for salmonids (Table 6-7). Deas and Orlob (1999) reported that higher flows from Iron Gate Dam in August resulted in water temperatures being reduced slightly (Table 6-7), but not reduced below the chronic or acute levels typical of summer conditions. The temperature of water released from Iron Gate Dam and temperature records at Seiad from late June through early September in many water year types approach or exceed acute thermal thresholds and may be a contributing factor to fish kills in the mainstem. Although fish do survive these temperatures, the complex relationship between summer/fall mainstem river flows and water temperatures, and their effects on the fishery in the Klamath River, limits Reclamation's ability to assess the Federal effects.

Table 6-7. Simulated effects of river flow on water temperatures in the Iron Gate Dam (RM 190) to Seiad Valley (RM 130) reach of the Klamath River for a typical mid-summer day

Simulated Iron Gate Dam flow (cfs)	Maximum diurnal temperature range in °C and (° F)	Simulated net temperature increase in the Iron Gate Dam to Seiad Valley reach in °C and (°F)	Travel time between Iron Gate Dam and Seiad Valley (days)	Mean temperature at Seiad Valley in °C and (°F)
500		2.5 (4.5)	2.5	25.0 (77.0)
1000	20-26 (68-79) @ RM 175	2.1 (3.8)	2.0	24.3 (75.7)
2000		1.3 (2.3)	1.5	23.5 (74.3)
3000	21-24 (70-75) @ RM 165	0.9 (1.6)	1.25	23.0 (73.4)

Source: Deas and Orlob 1999

Diurnal water temperatures, including maximum and minimum values, are also affected by flow regime. For low flows, daily maximum temperatures are higher and daily minimum water temperatures are lower, while at higher flows water temperature daily maximums are lower and minimum temperatures higher (Table 6-7). These diurnal fluctuations are for the "node of maximum fluctuation" (approximately a half day’s travel distance) and are not characteristic of the entire mainstem Klamath River. This phenomenon dampens with distance downstream from Iron Gate Dam. Only recently, since the early 1990s, have affordable instantaneous temperature measuring devices been available. Thus, field studies on diurnal temperature effects on fish have not been done. In the absence of information on diurnal temperature effects, temperature acclimation studies provide some indication of effects of temperature changes on fish. Armour (1991) reported on studies of the acclimation effects in juvenile Chinook salmon which found fish subjected to higher initial water temperature could sustain higher maximum temperature than those acclimated to cold water. The data suggested that, even if fish are acclimated to 20 °C (68 °F), 50 percent mortalities can be expected if temperatures reach 25.1 °C (77 °F) during the day.

Reclamation recognizes that tributaries can play a crucial role in creating local thermal refugia for juvenile coho salmon during the summer in the Klamath River. Belchik (1997) studied salmonid use of cool water areas in the Klamath River between Iron Gate Dam and Seiad Creek during July and August 1996, an above average water year. He found that there was a significant relationship between numbers of juvenile salmonids and proximity of nearest cool water areas in Klamath River mainstem. He indicated that cool water areas provide key habitat for over-summering juvenile salmonids. Most cool water areas were located at mouths of tributaries (Belchik 1997).

Reclamation’s Rogue River basin “with Reclamation” would result in minor flow decreases in the Klamath River as a result of diverting Jenny Creek flows to the Rogue River basin compared to “without Reclamation” from July through September (Figure 6-1 through Figure 6-10). However, based on temperature modeling, these low flow depletions would not likely affect water temperature appreciably. Table 6-7 suggests additional flow releases from Iron Gate Dam “without Reclamation” would not be expected to cool the mainstem river below the chronic temperature threshold of 15 °C (59 °F) for coho salmon during this period. Juvenile coho salmon in Klamath River from July through September are likely to encounter marginal to lethal water quality conditions regardless of the proposed action (Table 6-7 and Figure 6-1 through Figure 6-10). Daily average and maximum water temperatures are quite high, and the diurnal variation of temperatures may be stressful to fish.

The Klamath River has likely always been a relatively warm river system. Insolation and ambient air temperatures are primary factors affecting water temperatures in most rivers, including the Klamath. These climatic factors are completely independent and are not affected by Project operations. These factors influence water temperatures as distance increases downstream from Iron Gate Dam (Hecht and Kamman 1996;

Hanna 1997). Currently-depressed salmonid populations combined with successful introduction of numerous warm water fish species into the reservoir system suggests that natural climatic factors combined with major landscape alterations in the Klamath River watershed and its tributaries have caused higher water temperatures, thus favoring fish species other than salmonids.

Based on this analysis, the proposed action may affect, but not likely to adversely affect juvenile life stage or critical habitat for coho salmon in the Klamath River during this time period.

Effects of Flow on Adult Migration and Spawning from October through February

Reclamation stores water in Upper Klamath Lake and other Klamath Project reservoirs year-round, with a significant portion of the water being stored during October through March. In some years, storing water is significant in April, May, and June. The following analysis only considers the effects of storing water from October through February.

Adult coho salmon migrate into the Klamath River between September and January. The requirements of adult coho salmon during this time include a migratory corridor with suitable water depth and velocities, resting pools, and adequate water quality conditions (NMFS 2001). Successful immigration also depends on adequate fish passage conditions in the mainstem river and access to tributaries. Minimum Iron Gate Dam releases (September through January) under “with Reclamation” would vary slightly from “without Reclamation” conditions (Figure 6-1 through Figure 6-10). These small increments in flow changes related to the proposed action should not affect coho salmon migrations. Physical habitat modeling specific to adult coho salmon in the Klamath River has not occurred (NMFS 2001). Draft Hardy and Addley (2001) model results for Chinook salmon indicate spawning habitat is optimal at a flow of approximately 1,300 cfs in the Iron Gate Dam to Shasta River reach (NMFS 2001). Although it is reasonable to expect coho salmon to migrate successfully given this discharge and downstream flow accretions, this flow may not occur even under “without Reclamation” conditions in drier water years (Figure 6-4 and Figure 6-5). Also, tributary access would likely be affected by low flow with or without the proposed action in drier water years and would not be the sole result of the proposed action.

Available information indicates, in general, that water temperatures decrease in the Klamath River in October. By mid-October, temperatures measured at Iron Gate

Dam and at Seiad typically drop below 15 °C (59 °F) and are within the temperature range associated with normal coho salmon migration 7.2 °C – 15.5 °C (45-60 °F). By mid-December, temperatures typically decrease below 7.2 °C (45 °F) in these locations (NMFS 2001).

Passage conditions from the mainstem Klamath River into some tributaries have been a concern under relatively low flow conditions (Vogel and Marine 1994), particularly in dry years. Not only is access to the tributaries affected by mainstem passage conditions, but also by streambed and channel configurations and tributary flows. For example, substantial aggradation of large cobble and boulder material at the mouth of the Scott River creates a very shallow berm at low river flows that fish first entering this river must cross.

During drier years, low tributary flow may restrict passage independent of mainstem flows. The potential adverse effects to mainstem passage conditions and tributary access may result in spawning migration delays or straying due to natal stream inaccessibility. Because adult salmon do not feed during their freshwater spawning migration, individuals have a finite amount of energy reserves. Increased pre-spawning mortality and decreased spawning success may result under both "with Reclamation" and "without Reclamation"conditions in dry water years, as fish hold in the mainstem.

Although coho salmon have been observed spawning in the mainstem Klamath River (Reclamation 1998), it appears to be limited. Coho salmon spawning typically occurs during December and January in the Klamath River basin (Federal Register 60:38011). Klamath River water temperatures during the spawning period are typically within the acceptable range associated with coho salmon spawning in California 5.5 °C – 13.3 °C (42-56 °F) (Sandercock 1991).

Results of the spawning habitat analysis are summarized in Table 6-8 and Table 6-9. Examination of Table 6-8 shows that flows resulting from the proposed action generally slightly improve spawning habitat conditions compared to the "without Reclamation". Habitat increases occur during all water years in the October through February period except in dry years. The highest gain occurs in February of an average water year (+3 percent) between Iron Gate Dam and Shasta River. The greatest habitat loss occurs in February of dry water years (2.3 percent decrease) between Iron Gate Dam and Shasta River. Only minor spawning habitat gains would occur as a result of the "with Reclamation" in the Shasta River to Scott River reach of the Klamath River (Table 6-9).

Table 6-8. Chinook spawning habitat (percent optimal habitat) in the Klamath River between Iron Gate Dam and Shasta River confluence. "Without Reclamation" compared to "with Reclamation".

	Wet			Above Average			Average			Below Average			Dry		
Time Step	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change
October	54.0	54.6	1.1	76.6	77.1	0.6	87.6	88.1	0.5	100.0	100.0	0.0	89.9	89.9	0.0
November	71.0	71.2	0.3	93.1	93.3	0.1	93.7	93.9	0.2	94.6	94.9	0.3	92.7	92.5	-0.1
December	66.8	67.4	0.8	91.1	91.4	0.4	68.1	68.6	0.7	87.5	87.8	0.3	89.6	89.7	0.1
January	68.8	69.8	1.4	70.3	71.0	1.0	44.0	44.8	1.7	72.1	72.9	1.1	99.9	99.9	0.0
February	37.9	38.8	2.5	60.5	61.7	2.0	37.3	38.4	3.0	71.7	73.7	2.9	97.3	95.1	-2.3

Table 6-9. Chinook spawning habitat (percent optimal habitat) in the Klamath River between Shasta River and Scott River confluences; "Without Reclamation" compared to "with Reclamation".

	Wet			Above Average			Average			Below Average			Dry		
Time Step	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change	"Without Reclamation"	"With Reclamation"	Percent change
October	54.6	54.8	0.4	63.0	63.2	0.3	69.1	69.4	0.4	89.4	89.5	0.1	91.8	91.8	0.0
November	59.6	59.7	0.2	72.4	72.5	0.1	73.0	73.2	0.2	73.6	73.8	0.3	90.6	90.6	0.0
December	57.2	57.3	0.3	69.7	70.0	0.4	57.4	57.5	0.3	67.3	67.5	0.3	69.3	69.4	0.1
January	57.7	58.1	0.7	57.9	58.2	0.5	49.9	50.1	0.4	58.4	58.8	0.6	85.2	85.4	0.2
February	47.6	47.9	0.6	55.1	55.4	0.6	47.9	48.3	0.9	59.7	60.6	1.5	93.9	96.4	2.7

There is the potential effect during the spawning/egg incubation period of dewatering of incubating eggs if flows decline. Under “with Reclamation” and “without Reclamation” conditions flows generally decline between January and March in dry water years (Figure 6-5 and Figure 6-10). Thus, lower flow resulting from the “with Reclamation” and “without Reclamation” between January and March may result in some dewatering of incubating eggs in the mainstem Klamath River. However, the potential for this effect is small because of the small incremental change in flows would result in water depth changes that would not likely be detectable from “without Reclamation” flow changes.

Coho salmon eggs incubate for about 38-48 days in gravel redds following successful spawning, and fry emerge from the gravel about 2-3 weeks after hatching (Sandercock 1991). The survival of salmon eggs and alevins is dependent, in part, on stream and streambed conditions. For example, high winter flows and resulting gravel movement can result in heavy losses (Sandercock 1991). Flows released at Iron Gate Dam and downstream accretions are variable during this period both with and without the proposed action. Water temperatures measured at Seiad are typically similar to those at Iron Gate Dam during this period and within the preferred range for incubating salmonids.

Based on this analysis, the proposed action may affect, but not likely to adversely affect spawning/incubation life stages or critical habitat for coho salmon in the Klamath River during this time period.

6.2.3 Summary of Effects

Table 6-10 summarizes effects of the proposed action on SONCC coho salmon in the Rogue River and Klamath River basins. Table 6-12 uses the NMFS habitat matrix to summarize habitat features where we had sufficient data and notes the effects of the proposed action on coho salmon critical habitat.

In general, Reclamation’s proposed action degrades summer temperatures, fish passage, and baseline hydrology in the Little Butte Creek and Bear Creek watersheds.

Overall, Reclamation’s proposed action is likely to adversely affect most life stages of SONCC coho salmon in the Rogue River basin. In the Klamath River basin, the Project may affect, but is not likely to adversely affect most life stages of SONCC coho salmon. There is no effect on the remainder of the life stages.

Table 6-10. Summary of Effects on SONCC Coho Salmon and Critical Habitat (“with Reclamation” compared to “without Reclamation”)

Stream Segment	Fry, Juvenile, Smolt (February - June)	Juveniles (July - September)	Adult Migration and Spawning (October - February)
Rogue River basin			
S. F. Little Butte Creek	Potential negative effect from low flows February – June. MA/LAA	Generally moderate-minor flow decreases; water operations are likely to affect water temperatures in some stream reaches. MA/LAA	Generally lower Proposed action flows may affect adult coho migrations in dry years, particularly in October. MA/LAA
Little Butte Creek	Potential negative effect from low flows in May of dry years. MA/LAA	Major flow increases in average and wet years; no change in dry years; water temperatures should be unaffected by operations. NE	Generally higher Proposed action flows is not likely to adversely affect coho salmon. MA/NLAA
Antelope Creek	Potential negative effects from low flows resulting from water diversion. MA/LAA	No summer diversions; water temperatures should be unaffected by operations. NE	Antelope Creek Diversion Dam may affect adult coho migrations with 1-cfs minimum flow. MA/LAA

Stream Segment	Fry, Juvenile, Smolt (February - June)	Juveniles (July - September)	Adult Migration and Spawning (October - February)
Emigrant Creek	Rapid down-ramping at Emigrant Dam may strand small fish; negative effects from zero flows February – June in dry years. MA/LAA	Wide flow fluctuations from storage releases at Emigrant Dam likely adversely affect fish habitat, including stranding of juveniles and preventing establishment of aquatic macroinvertebrates. MA/LAA	Zero flow during average and dry Octobers – February adversely affects potential adult coho migrations. MA/LAA
Bear Creek	Potential negative effects from low flows in average and dry years February – June. Potential adverse effects from not meeting fish passage criteria where canals cross tributaries. No fish passage provisions in Phoenix Canal may adversely affect smolts and jueniles. MA/LAA	Operations increase flows in most of Bear Creek; water withdrawal from tributaries may have negative (streamflow depletions) and positive effects (increased flows from irrigation water conveyance) on water temperature and fish habitat. Potential adverse effects from not meeting fish passage criteria where canals cross tributaries. No fish passage provisions in Phoenix Canal may adversely affect juveniles during irrigation season. MA/LAA	Major flow decreases in January and February may adversely affect adult fish passage into tributaries. Potential adverse effects from not meeting fish passage criteria where canals cross tributaries. MA/LAA
Klamath River basin			
Klamath River (Iron Gate Dam – Shasta River)	Minor decreases in fry habitat should not adversely affect coho survival. NE	Minor flow decreases not likely to adversely affect water temperature. MA/NLAA	Minor spawning habitat changes (gains and losses) should not adversely affect coho salmon. MA/NLAA
Klamath River (Shasta River – Scott River)	Minor decreases in fry habitat should not adversely affect coho survival. NE	Minor flow decreases not likely to adversely affect water temperature. MA/NLAA	Only minor spawning habitat gains with proposed action should not adversely affect coho salmon. NE

Table 6-11. NMFS matrix checklist documenting environmental baseline and general effects of Reclamation's operations on SONCC coho salmon critical habitat

Pathways	Environmental Baseline			Effects Of Actions		
Indicators	**Properly Functioning**	**At Risk**	**Not Properly Functioning**	**Restore**	**Maintain**	**Degrade**
Water Quality						
Temperature		X				X
Sediment/Turbidity		X			X	
Chemical Contaminants/ Nutrients		X			X	
Habitat Access						
Physical barriers		X				X
Habitat Elements						
Substrate	UNK			UNK		
Large woody debris		X			X	
Pool Frequency	UNK			UNK		
Pool Quality	UNK	X		UNK		
Off-channel Habitat	N/A			N/A		
Refugia	UNK	X		UNK		
Channel Conditions and Dynamics						
Width/Depth ratio	UNK			UNK		
Streambank condition		X			X	
Floodplain connectivity		X			X	
Flow/Hydrology						
Change in Peak/Base Flows	X					X
Increase in Drainage Network	N/A			N/A		
Watershed Conditions						
Road density and location	X				X	
Disturbance history		X			X	
Riparian Reserves	UNK			UNK		
UNK = unknownN/A = not applicable						

6.3 Lost River and Shortnose Suckers

6.3.1 Effects of Transbasin Water Diversion in Jenny Creek

Annual computed transbasin diversion from Jenny Creek ranged from 0 to 42,342 acre-feet between 1961 and 2001 and averaged 24,230 acre-feet. ODWR 50 percent exceedence runoff for Jenny Creek at the mouth is 51,198 acre-feet (estimated unimpaired flow) during the water years 1958-1987 (Cooper 2000). Water years 1958 to 1987 were selected as a base period due to the availability of data and the period's representation of the long-term average conditions. The average annual transbasin diversion for this time period was 23,178 acre-feet which represents 47 percent of the 50 percent exceedence runoff.

The seasonal pattern of natural runoff based on ODWR's 50-percent exceedance flows show 66 percent of the annual water year runoff occurs from March through May. These monthly flows range from 5,737 acre-feet in May to 14,757 acre-feet in April. Exceedance flows from June through September comprise 6.5 percent of the annual water year runoff ranging from 464 acre-feet in September to 1,529 acre-feet in June.

Suckers don't occupy Jenny Creek above the waterfalls; therefore, there are no direct effects on endangered suckers.

The lower 2 miles of Jenny Creek downstream from the waterfalls are proposed critical habitat for endangered suckers. The proposed action results in flow reductions and some unquantified reduction in potential sucker spawning habitat. The proposed action has little effect on water quality because most inflow from Jenny Creek occurs during the spring when Iron Gate Reservoir water quality is good and inflow from Klamath River is high. During the summer when water quality in Iron Gate Reservoir is poor, Jenny Creek inflows are very low and have a negligible effect on reservoir water.

6.3.2 Effects of Transbasin Water Diversion in Iron Gate Reservoir

The water level of Iron Gate Reservoir is unaffected by the transbasin diversion due to the small size of the reservoir and large volume of water received from the upper Klamath River basin.

Iron Gate Reservoir may provide habitat for a residual spawning population of suckers. The reservoir, however, doesn't support a viable population of suckers because of poor water quality during summer months, lack of larval and juvenile shoreline habitat, lack of spawning habitat, dominance of exotic predatory fish, and lack of fish passage facilities.

Summary of Effects

Reclamation determined the effects of ongoing operations may affect but are not likely to adversely affect Lost River and shortnose suckers. Further, Reclamation determined the proposed action is likely to adversely modify proposed critical habitat for endangered suckers in Jenny Creek. These determinations are made based on the following information:

Iron Gate Reservoir water level is unaffected by the transbasin diversion due to the small size of Iron Gate Reservoir and the large volume of water received from upper Klamath basin. Daily fluctuation related to power generation average 0.5 feet and the maximum fluctuation between minimum and full pool elevations is 8 feet (PacificCorp 2000).

Water quality has little effect from the operation of the proposed action because most inflow from Jenny Creek occurs during spring when Iron Gate Reservoir water quality is good and inflow from Klamath River is high.

Flow reduction in Jenny Creek may reduce potential sucker spawning habitat, thus affecting proposed critical habitat for sucker spawning during drier years.

6.4 Northern Spotted Owl

The greatest threat facing the northern spotted owl is the loss and fragmentation of habitat mainly through timber harvest and forest fires. The drought and accompanying severe fire seasons in recent years are threats to spotted owl recovery in the Pacific Northwest where fuels have accumulated over decades of fire suppression. These primary causes of spotted owl decline would have occurred even if Reclamation's Rogue River Basin Project had never been constructed. The harvest of trees, particularly the practices of clear-cutting and the high priority of harvesting the largest, oldest trees are more problematic to spotted owl conservation than any other identified threat. Secondarily, fire management policies, now recognized as detrimental to ecosystem health have led to more frequent and more destructive large-scale fires which have the same effect of eliminating and fragmenting spotted owl habitat.

Reclamation determined that there were five spotted owl activity centers located within one-mile of Reclamation facilities while analyzing the effects of operations on the northern spotted owl. Spotted owl activity centers are areas where a single owl or pair have a home range. All five of these activity center locations are in the Klamath River basin on BLM administered lands.

Typical spotted owl habitat is mid to high elevation mature forest where there are uneven-aged stands of conifers. Spotted owls do not seem to show any affinity towards nesting or maintaining home ranges near large bodies of water. Spotted owls are not attracted to reservoirs, dams, or canals for prey items because the small rodents that make up the spotted owl's diet are also easily found away from these structures. Water is supplied to irrigators primarily in low elevation lands in Bear Creek drainage where human populations are aggregated, and therefore, suitable spotted owl habitat does not exist.

The storage of water in high elevation reservoirs and canals occurs in areas of suitable spotted owl habitat. Hyatt Reservoir and Howard Prairie Lake and their associated dams and canals are located in the southern end of the Cascade Range in coniferous forest. Hyatt Reservoir has no spotted owl activity centers located within approximately one mile of its shoreline, while a total of five activity centers each within approximately one mile of a Reclamation facility have been identified near Howard Prairie Lake, Howard Prairie Canal, and Soda Creek Canal.

With respect to the operation and maintenance of the Howard Prairie and Soda Creek Canals, spotted owl habitat and prey are not affected by the presence of these water conveyance structures. The operation of Reclamation's reservoirs does not affect spotted owls directly, but the presence of these large water bodies does draw people to recreate on and around the reservoirs. Camping areas are at both lakes, although at Hyatt Reservoir campgrounds are less developed, more dispersed, and there are privately owned cabins. Howard Prairie Lake has more fee campgrounds and recreational facilities as well as dispersed camping on adjacent BLM land.

Summary of Effects

Based on the current identified threats to the northern spotted owl and the life history characteristics of this species, the proposed action does not affect northern spotted owls. However, recreational pursuits in the area of Howard Prairie Lake may have indirect effects on owl life functions. Recreational activities and management in the vicinity of spotted owl habitats are under BLM jurisdiction.

6.5 Bald Eagle

6.5.1 Analysis approach

The annual operation and maintenance of Reclamation dams and reservoirs may have an effect on both nesting and wintering bald eagles, primarily by affecting their primary prey base of fish and, to a lesser extent, waterfowl. Seasonal fluctuations in reservoir levels and alterations in stream flows below Reclamation dams may have direct effects on the quantity and quality of habitat of prey populations, therefore, may influence prey health and abundance. These operations may also affect the ability of bald eagles to exploit the available prey species, by making prey more or less vulnerable to predation.

In assessing the effects of continued operation and maintenance activities at Federal reservoirs it is important to recognize that the bald eagle population inhabiting these areas has been attracted to and has adapted, at least in part, to the conditions which have been and will continue to be present, such as fluctuating water levels which affect abundance and availability of prey. Indeed, the bald eagle population in the basin has been growing over the last 30 years in spite of changes in annual and seasonal operation scenarios dictated by differing hydrologic conditions.

The analysis approach assumes the presence of Federal reservoirs. The "without Reclamation" operations, described in this BA, are not applicable to this analysis because they eliminate Reclamation facilities. Since the growing eagle population has experienced and adapted to the existence of Federal reservoirs for the last 30 years, it is reasonable to establish the existence of reservoirs and use historic operations as the "without Reclamation" conditions by which to evaluate the effect of operations on the bald eagle population.

Howard Prairie Lake

The surface of Howard Prairie Lake seldom freezes over completely. Bald eagles are able to forage year-round and are usually observed at Howard Prairie Lake between breeding seasons, i.e. wintering. The ODFW stocks Howard Prairie Lake annually in May with over 300,000 hatchery fingerling rainbow trout. The stocking program provides a consistent prey base for the local eagle population.

The water level in Howard Prairie Lake fluctuates seasonally and varies due to hydrologic conditions. Prey fish species will be affected by reservoir operations and this may affect bald eagles. In wet years the reservoir may contain over 60,000 acre feet of water and during especially dry years it may be below 10,000 acre feet. Since bald eagles have been breeding at Howard Prairie Lake there have been both wet and dry years. From 1983 through 1999 there have been eight winters where storage in the reservoir peaked at over 60,000 acre feet, 4 years when the reservoir reached its highest storage level between 40,000 and 60,000 acre feet, and 4 years where storage was below 40,000 acre feet. During this 16-year period bald eagle breeding success has also fluctuated but there does not appear to be a discernable relationship between reservoir operations and breeding success (Figure 6-13).

The addition of new breeding territories has increased the potential number of chicks that could be fledged at Howard Prairie Lake; if all pairs are successful in the same year from 1-2 chicks annually (when there was one breeding territory) to 3-6 or more (with 3 territories now active). In the drier years occurring from 1988 to 1995 there was the establishment of the reservoir's second breeding territory and 2 successive years when 3 chicks fledged. Following those dry years there was another cycle of better years (1996-1999) and reproductive success was low overall. In 1999, Howard Prairie eagle pairs raised a total of 4 chicks, the most successful year to date. Howard Prairie operations do not appear to be adversely affecting bald eagles.

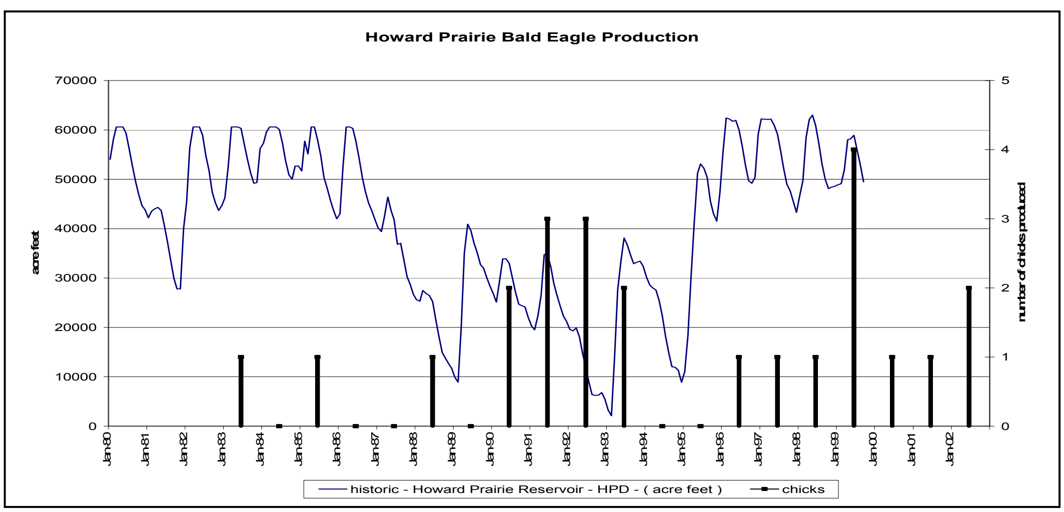

Figure 6-13. Bald eagle production at Howard Prairie Lake.

Hyatt Reservoir

Hyatt Reservoir has had one breeding territory since 1973 (perhaps longer) with no additional territories being established. One characteristic is its high density of osprey; often there are as many as 10 nesting pairs at the reservoir (Kaiser 2001). Competition for prey between eagles and osprey may be prohibiting new pairs from nesting at Hyatt Reservoir. Available fish prey include 250,000 fingerling and over 17,000 legal size rainbow trout supplied by ODFW fish hatcheries in April and May. The reservoir is not a known wintering site for eagles because the lake usually freezes over and eagles are seldom observed in the area outside the breeding season.

Since eagle nest monitoring began in Oregon in 1973 the Hyatt nest has produced 26 chicks (0.87 chicks/year). There have been 10 years during this period that the nest did not produce any chicks (Figure 6-14). Lake storage peaked at over 16,000 acre feet in some of those years. Other years when the nest failed to produce young the lake dropped to 500 acre feet (September 1994). In Hyatt Reservoir's driest year, when the lake was completely dry by August in 1992 the eagle pair was able to produce one eaglet. Hyatt Reservoir operations do not appear to have a negative affect on bald eagle reproduction.

Emigrant Lake

The bald eagles at Emigrant Lake prey on fish in the lake including 6,500 precocial winter steelhead and 7,000 legal size rainbow trout supplied by ODFW in March and April. It is likely that the nesting pair also winters in the vicinity of the lake since Emigrant Lake does not freeze in the winter.

When the eagles established a nest near Emigrant Lake in 1993, the previous winter the reservoir stored over 38,000 acre feet at it's peak storage. In 1994, the reservoir dropped to 1,000 acre feet in August. The following five years, from 1995 to 1999 reservoir storage fluctuated seasonally between approximately 15,000 and 38,000 acre feet and the eagle pair still did not successfully produce young. In 2000, the eagles moved to a new nest location downslope from the previous site and since then have produced one chick annually (2000-2001). It appears that the difference in elevation between the nest and the lake was likely the cause of nest failure, although other factors may also have contributed, reservoir operations do not seem to be associated with poor breeding success (Figure 6-15).

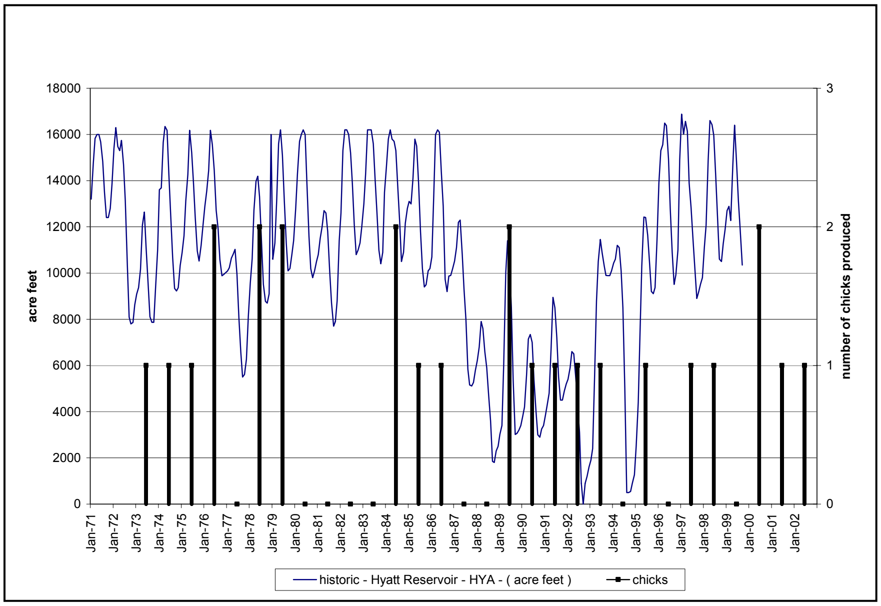

Figure 6-14. Bald eagle production at Hyatt Reservoir.

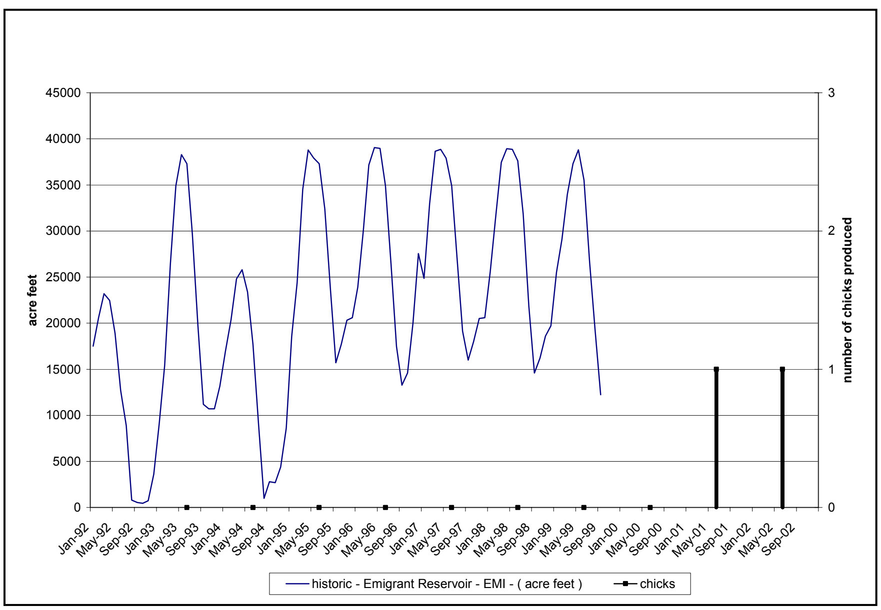

Figure 6-15. Bald eagle production at Emigrant Lake.

6.5.2 Effects of Transbasin Water Transfer on Bald Eagles in Klamath River Basin

The small transbasin water transfers of upper Klamath River basin inflow from Jenny Creek average about 24,230 acre-feet to the Rogue River basin.

Reclamation's Klamath Area Office consulted on the effects of Klamath Project operation on threatened bald eagles in 1992 and 2001 (Reclamation 1992 and 2001). USFWS determined in both the 1992 and 2001 biological opinions that the proposed Klamath Project operation is not likely to jeopardize the continued existence of the bald eagle (USFWS 1992 and 2001). However, USFWS indicated in 2001 the Klamath Project proposed action is likely to result in significant reduction or elimination of the prey base for the bald eagle due to curtailed water deliveries to areas containing important eagle feeding habitat. USFWS included Reasonable and Prudent Measures in the 2001 biological opinion to minimize impacts of the take.

Summary of Effects

Based on the analysis, bald eagle survival and fecundity do not appear to be negatively affected by the proposed action. Bald eagle populations are increasing statewide and in the local area. Large open bodies of water stocked with fish have provided forage for the eagles during annual breeding and wintering periods. The characteristic sensitivity of eagles to humans during their breeding season may be a concern if recreation is not planned and managed with this species in mind. Overall, the proposed action may affect, but is not likely to adversely affect bald eagles.

6.6 Gentner's Fritillary

Gentner's fritillary grow in forest openings within three habitats: oak woodlands dominated by Oregon white oak, mixed hardwood forests dominated by Pacific madrone, and coniferous forests dominated by Douglas fir.

Gentner's fritillary is threatened by disturbance, alteration, and loss of habitat. It does not appear to be an early colonizer of recently disturbed habitat, nor a late successional species found in old growth, closed canopy forests. This species prefers situations where it can receive at least partial light. It appears to have a moisture requirement in that it has not been found in fully exposed rocky, skeletal soil types (e.g., open grasslands), but prefers a level of soil moisture that is also capable of supporting trees and shrubs. Its relationship with disturbance is not clear, although the species exists in communities that had fairly frequent fire return intervals historically.

The nearest population center is one-half mile from the Phoenix Canal. Operations and maintenance will not impact plant populations or associated forested habitat. Therefore, the proposed action has no effect on Gentner's fritillary.

6.7 Vernal Pool Species

6.7.1 Factors Influencing the Hydrology of Vernal Pools

Although precipitation typically fills vernal pools, vernal pool hydrology can be influenced by a variety of factors. Ongoing operations may impact Agate Desert vernal pools by altering their hydrologic regime. Potential impacts to vernal pools and listed species habitat can be classified as follows where vernal pools occur on or adjacent to irrigated lands and the associated water distribution system (Patterson 2001):

- Conversion. Vernal pool habitat may occur within current Project land parcels which have only been partially converted to cultivated fields by ripping the duripan and leveling the soil. These areas may be subject to future conversion due to the availability of irrigation water.
- Direct Application. Vernal pool habitat may persist in areas of irrigated pasture where topographic alteration has not totally eliminated surface ponding. These pools may be subject to application of water in late spring and summer depending on individual irrigation practices. This could result in conversion to emergent aquatic plant species and loss of vernal pool species.
- Waste. Vernal pool habitat may occur adjacent to or downslope from Project lands and unused irrigation runoff may cause adverse effects. Dry-season irrigation runoff flowing into off-site vernal pools will increase populations of drought-intolerant wetland species and displace native vernal pools species.
- Impoundment. Temporary impoundment of water can result in increased water durations and depths in natural vernal pools where water delivery canals and distribution laterals interrupt surface runoff in vernal pool landscapes. Natural vernal pools normally have contributing watersheds of less than five times their surface area. Artificial structures such as berms adjacent to canals and laterals can result in diversion of large watersheds into individual pools.

The impacts considered in the analysis are for a worst-case scenario and are based on proximity of vernal pool complexes to irrigated lands or water conveyance facilities;

therefore actual impacts are likely to be less severe. Table 6-12 shows acres of potential impact to vernal pool habitat. The impact analysis was organized by irrigation district boundaries. The effects from the proposed action include areas only near Agate Lake and Hopkins Canal (interrelated and interdependent facilities). The Agate Lake Resource Management Plan provides more detail on areas immediately adjacent to Agate Lake (Reclamation 2000).

Table 6-12. Acres of Potential Impact to Vernal Pool Habitat by Impact Type and Irrigation District

	C/D	C/D/I	C/D/W	C/D/W/I	D	I	W	W/I	Total
MID	102.5		43.1			4.3	87.6	3.4	240.9
RRVID	408.6	10.8	21.6	0.7	8.9	8.8	99.4	17.3	576.1
Total	511.1	10.8	64.7	0.7	8.9	13.1	187	20.7	817
C = Conversion D = Direct Application I = Impoundment W = Waste Flow									

	Conversion	Direct Application	Waste	Impoundment
MID	145.6	145.6	91	7.7
RRVID	441.7	450.6	116.7	26.1
Total	587.3	596.2	207.7	33.8

Source: Patterson 2001

Figure 6-16 displays the spatial configuration of remaining vernal pool complexes, their relative habitat value based on a function and condition assessment (Borgias and Patterson 1999), and which vernal pool complexes may be affected. Seven criteria used in the function and condition assessment are:

- complex size
- average vernal pool abundance within each complex
- listed nonendemic species (vernal pool fairy shrimp)
- endemic plant species (large-flowered woolly meadowfoam, Cook's lomatium)
- probable historic ranges of vernal pool fairy shrimp, large-flowered wooly meadowfoam, and Cook's lomatium
- complex condition (native species diversity, habitat diversity, lack of physical disturbance, and lack of major nonnative species competition)
- defensibility of the complex (compatible land uses, watershed integrity, and lack of adverse edge effects

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ROGUE RIVER VALLEY IRRIGATION DISTRICT

MEDFORD IRRIGATION DISTRICT

U.S. BUREAU OF RECLAMATION

VERNAL POOL IMPACT ANALYSIS

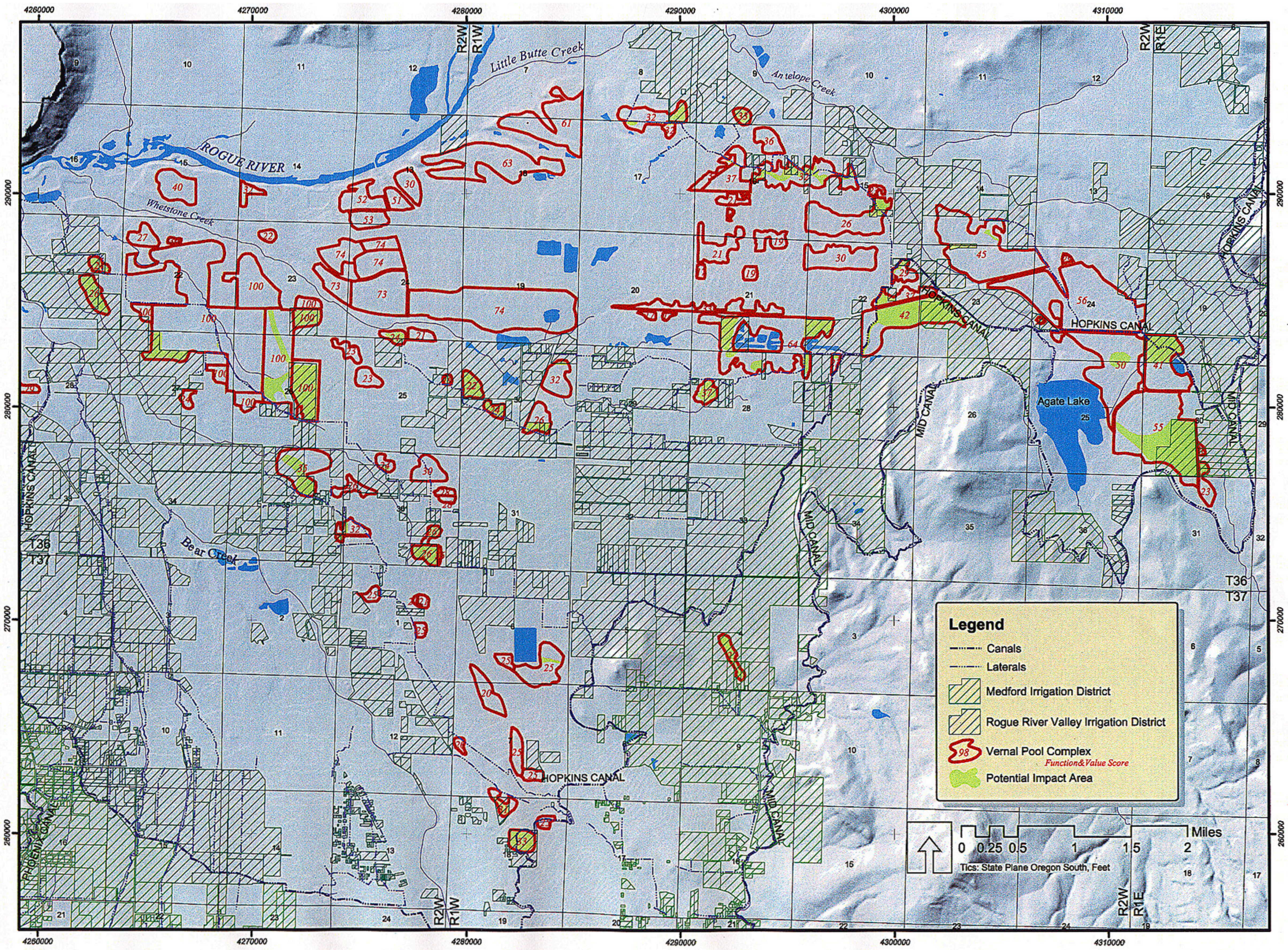

Figure 6-16

6.7.2 Large-Flowered Woolly Meadowfoam

Patterson (2001) estimated 817 acres of vernal pool complex habitat, all within the range of large-flowered woolly meadowfoam, may be potentially impacted by altered hydrology as a result of the Project (Table 6-12). Some 211.4 of the potentially impacted acres are in vernal pool complexes from which the species has been recorded (Table 6-13). All of these acres are lands within the boundaries of or are affected by RRVID. Some 605.6 of the potentially impacted acres are in vernal pool complexes within the known range but from which large-flowered woolly meadowfoam has not been recorded. Of these acres, 240.9 are lands within or potentially affected by MID and 364.7 are lands within or potentially affected by RRVID.

Table 6-13. Acres of Potential Impact to Large-flowered Woolly Meadowfoam by Irrigation District and Distribution Data

	Not Within Known Range	Within Known Range But Not Recorded From Complex Where Potential Impact Is Mapped	Recorded From Complex Where Potential Impact Is Mapped
MID	0	240.9	0
RRVID	0	364.7	211.4
Total	0	605.6	211.4

Source: Patterson 2001

Large-flowered woolly meadowfoam occupies 3,264 acres of vernal pool complex (Patterson 2001). Thus, approximately 6.5 percent (211.4/3,264) of the acreage in which this species occurs may be impacted.

Summary of Effects

Ongoing operations are likely to adversely affect some Agate Desert occurrences of large-flowered woolly meadowfoam by continuing to alter the hydrologic regime under which the vernal pools formed and the species evolved. Impacts are related to alterations of the natural hydrologic regime that sustains vernal pools. Approximately 211.4 acres of vernal pool complex from which the species has been recorded may be adversely affected by any or all of the following: conversion, direct application, wastewater runoff, and impoundment. This represents approximately 6.5 percent of the acreage of vernal pool complex which is occupied by the species. An additional, 394.2 acres within the known range but without species records may be similarly impacted. Surveys will likely be necessary to determine and confirm actual impacts of ongoing Federal operation and maintenance activities on remaining Agate Desert vernal pool habitats.

6.7.3 Cook's Lomatium

Of the 817 acres of vernal pool habitat that could be potentially impacted by altered hydrology from ongoing operations (Table 6-12), 616 of these acres are within the known range of Cook's lomatium (Table 6-14). Some 332.7 of the potentially impacted acres are in vernal pool complexes from which the species has been recorded. Of these, 94.3 acres are within the boundaries of or are potentially affected by MID and 238.4 acres are within the boundaries of or are potentially affected by RRVID. Some 283.3 of the potentially impacted acres are in vernal pool complexes within the known range in Agate Desert but from which Cook's lomatium has not been recorded. All of these acres are lands within the boundaries of or are potentially affected by RRVID.

Table 6-14. Acres of Potential Impact to Cook's Lomatium by Irrigation District and Distribution Data

	Not Within Known Range in Agate Desert	Within Known Range But Not Recorded From Complex Where Potential Impact Is Mapped	Recorded From Complex Where Potential Impact Is Mapped
MID	146.6	0	94.3
RRVID	54.4	283.3	238.4
Total	201	283.3	332.7

Source: Patterson 2001

Cook's lomatium occupies 2,167 acres of vernal pool complex in the Agate Desert (Patterson 2001). Thus, approximately 15 percent (332.7/2,167) of the vernal pool complex acreage in which this species occurs may potentially be impacted by ongoing operations.

Summary of Effects

Ongoing operations are likely to adversely affect some Agate Desert occurrences of Cook's lomatium by continuing to alter the hydrologic regime under which the vernal pools formed and species evolved. Impacts are related to alterations of the natural hydrologic regimes that sustain vernal pools in the Agate Desert. Approximately 333 acres of vernal pool complex from which the species has been recorded may potentially be affected by conversion, direct application, wastewater runoff, and impoundment. This represents approximately 15 percent of the vernal pool complex acreage occupied by Cook's lomatium. An additional 283 acres within the known range but without species records may be similarly impacted. Surveys will likely be necessary to determine and confirm actual impacts of ongoing Federal operation and maintenance activities on remaining Agate Desert vernal pool habitat occupied by this species.

6.7.4 Vernal Pool Fairy Shrimp

Patterson (2001) estimated 817 acres of vernal pool habitat, all within the known range within Agate Desert of vernal pool fairy shrimp, may be potentially impacted by altered hydrology (Table 6-12). Many potential impact areas are subject to more than one impact type. Some 491.5 of the potentially impacted acres are in vernal pool complexes from which vernal pool fairy shrimp have been recorded (Table 6-15). Of these, 218.8 acres are within the boundaries of or are potentially affected by MID and 272.7 acres are within the boundaries of or are potentially affected by RRVID. Some 325.5 of the potentially impacted acres are in vernal pool complexes from which the vernal pool fairy shrimp have not been recorded. Of these, 22.1 acres are within the boundaries of or are potentially affected by MID, and 303.4 acres are within the boundaries of or are potentially affected by RRVID.

Table 6-15. Acres of Potential Impact to Vernal Pool Fairy Shrimp

	Not Within Known Range	Within Known Range But Not Recorded From Complex Where Potential Impact Is Mapped	Recorded From Complex Where Potential Impact Is Mapped
MID	0	22.1	218.8
RRVID	0	303.4	272.7
Total	0	325.5	491.5

Source: Patterson 2001

Acres of occupied habitat potentially impacted by pesticide, fertilizer application, and runoff would be similar to acres potentially impacted by altered hydrology (817 acres).

Summary of Effects

Ongoing operations are likely to adversely affect some Agate Desert vernal pool fairy shrimp habitats by continuing to alter the hydrologic regime under which the vernal pools formed and vernal pool fairy shrimp evolved. Approximately 17 percent (817 acres of potential impact/4,700 acres of remaining vernal pool complex habitat) of the remaining vernal pool acreage in Agate Desert may potentially be adversely affected by any or all of the following: conversion, direct application, wastewater runoff, and impoundment. This potential impact acreage represents approximately 4 percent (817 acres of the 21,000 acres of vernal pool complex habitat historically present) of the historic extent of vernal pool habitat in Agate Desert. Surveys will likely be necessary to determine and confirm actual impacts of ongoing Federal operation and maintenance activities on remaining Agate Desert vernal pool habitats.

7.0 Cumulative Effects

7.1 Introduction

Cumulative effects include the effects of future State, tribal, local, or private actions, not involving a Federal action, that are reasonably certain to occur in the action area (50 CFR 402.14 (g) (3)). Cumulative effects exist only when they are reasonably certain to occur. A key factor in determining if an action meets the definition of a cumulative action is the "reasonably certain to occur" phrase. To meet this standard, there must exist more than a mere possibility that the action may proceed.

Past actions of the groups listed below are included in Chapter 4. Reclamation coordinates with these groups as requested and within Reclamation's authorizations and funding. This section provides a brief history, past accomplishments, and future efforts for each group. The brief history and past accomplishments are included here because the future efforts are incremental steps of past accomplishments.

7.2 SONCC Coho Salmon

7.2.1 Rogue River Basin

Local Coordinating Groups

Irrigation Point of Diversion (IPOD) and Little Butte/Bear Creek Water Management Project

In 1999, in response to the issue of poor water quality at their intake facility, the Medford Water Commission began examining the potential of increasing stream flows in Little Butte Creek. The IPOD group was formed to generate a proposal to improve water quality.

In 2000, it was recognized that the scope of the project had grown well beyond that of the original IPOD project both geographically and functionally. The name was changed to the Little Butte/Bear Creek Water Management Project.

The Little Butte/Bear Creek Water Management Project is a collaborative effort of diverse stakeholders to improve the health of the Little Butte Creek and Bear Creek systems and increase the effectiveness and efficiency of the three local irrigation districts: MID, TID, and RRVID. Their goals are to increase instream flows in Little

Butte Creek and Bear Creek and tributaries and to improve irrigation efficiency within the three irrigation districts.

The work accomplished to date, includes the development of a set of alternatives for meeting the project goals, development of a hydrology model to ascertain the potential of each alternative, development of key stakeholder involvement, and initiation of the process of determining the feasibility of using reclaimed effluent (Mason 2002).

The Little Butte/Bear Creek Water Management Project future plans include:

- Piping and lining canals,
- Increasing the storage capacity of selected reservoirs,
- Installation of a pumping station to provide access to water from the Regional Wastewater Reclamation Facility and water stored in Lost Creek Reservoir

These potential projects are at the planning stage with future steps to include a feasibility study and environmental compliance documents.

A specific pilot project is planned to use reclaimed effluent from the Medford Regional Water Reclamation Facility for irrigation purposes. This project will pump reclaimed effluent water to approximately 500 acres in the RRVID. This pilot project should be functional in 2003 or 2004.

Rogue Basin Coordinating Council (RBCC)

RBCC was formed in 1998 to coordinate and promote the work of eight watershed councils within the Rogue River basin. Communities in the basin range from Gold Beach on the Pacific Ocean to Trail, about 155 miles upstream. To support the RBCC, the Rogue Basin Fish Access Team (RBFAT) was formed to identify and prioritize fish passage barriers within the basin and form a strategic plan for their removal or modification. The Strategic Plan was completed in 2000 and RBFAT now serves as an advisory committee to RBCC.

The mission of RBFAT is to improve fish passage throughout the Rogue basin. The first step in fulfilling this mission was the generation of a biologically prioritized list of the over 800 fish passage barriers in the Rogue basin. The second step was the development of a Strategic Plan for addressing these barriers. Rogue basin Coordinating Council is now working on the third step of establishing a Basin Fund for the removal or modification of the barriers.

Specific timeframes to accomplish these goals have not been established.

The Rogue Valley Council of Governments (RVCOG)

RVCOG is a voluntary association of 15 local governments and six other jurisdictions in southwestern Oregon's Jackson and Josephine Counties.

RVCOG, Bear Creek Watershed Council (BCWC), and Jackson Soil and Water Conservation District have worked closely with Federal, state, and local agencies as well as water users and other interested parties to assist in the development and implementation of strategies for restoration, enhancement, and protection of the Bear Creek Watershed.

In 1995, RVCOG completed the Bear Creek Watershed Assessment and Action Plan, Phase I. Work on Phase II of this project began in 2001 and is intended to expand the assessment to incorporate information on tributaries, water quality, fishery habitat conditions, and address federal and state regulatory mandates implemented in recent years. The report has not yet been completed due to lack of funding.

RVCOG will work with irrigation districts to conduct a water conservation and fish protection education program. The program will identify appropriate participants, conduct neighborhood workshops, host an irrigation fair/trade show, and produce an informational pamphlet.

Jackson County Water Needs and Availability Project (WNAP)

WNAP has three goals: to evaluate the availability of water for future uses, to determine the amount of water that will be needed for future uses, and to develop means to ensure that there will be enough water available in the future to meet future water use needs. The first two goals are based on the recently completed Jackson County Water Resources Study. The third goal includes developing new sources of water or water storage through construction and conservation and redistribution of existing water. WNAP's area of work is Jackson County. All types of water uses will be evaluated: agricultural, instream, municipal and industrial. Groundwater is not being evaluated.

Rogue Aggregates Inc.

The project proposes to prevent pit capture by the Rogue River of abandoned floodplain gravel pits by constructing four stream barbs to arrest bank erosion. The project will protect fish habitats and water quality. The implementation of the project will help prevent future channel avulsion and resulting impacts to fisheries and habitats. Oregon Watershed Enhancement Board provided funding in 2002 for post-construction modeling, trucking of rock, barb construction preparation of construction specifications, monitoring, and fiscal management.

Oregon Department of Fish and Wildlife

PacifiCorp requested a waiver for upstream fish passage at the North Fork Diversion Dam because passage would provide little biological value to native fish. A series of waterfalls about a mile downstream of the dam naturally prevent fish passage, and the area immediately below the dam has low quality fish habitat because it is dominated by bedrock with sparse amounts of potential spawning gravel.

The Fish and Wildlife Commission approved a waiver to fish passage under fish migration laws at the North Fork Dam in the upper Rogue River because the hydropower company has agreed to improve fish passage at Little Butte Mill Dam in the Rogue basin.

As a result of the waiver, PacifiCorp will pay about $175,000 to improve a non-functional fish ladder, notch the dam crest, and modify the channel to improve fish passage during low flows at Little Butte Mill Dam. The project, located near Eagle Point, will improve fish accessibility to 68 stream miles above Little Butte Dam for rainbow trout, cutthroat trout, Chinook, steelhead, coho, Pacific lamprey, Pacific brook lamprey, and Klamath small scale sucker. If fish passage was provided at North Fork Dam, only an additional 0.9 miles of stream would be available to resident rainbow and cutthroat trout.

Local Irrigation Districts

The districts are planning fish passage improvements at Larson Creek, a tributary of Bear Creek. Environmental compliance on new fish facilities for North and South Fork Little Butte has been completed. The South Fork fish screens have been completed and the ladder is schedule for construction in the summer of 2003. The North Fork screens are scheduled for construction in the fall of 2003 with the construction of the fish ladder following in 2004.

7.2.2 Klamath River Basin

The action area in Klamath River basin, for purposes of this analysis, encompasses aquatic habitat in Klamath River downstream from Iron Gate Dam. Cumulative effects of State and private activities on anadromous fish species in Klamath River basin are significant. Dominant land-use activities on non-federal lands adjacent to the action area are forestry and agriculture. Significant improvements in SONCC coho salmon production within non-Federal lands are unlikely without changes in forestry, agriculture, and other practices that occur in aquatic and riparian habitats.

Return flows coupled with consumptive uses of water; depending on land-use practices, irrigation methods, use of agrichemicals, number of reuses, and erosion in agricultural areas contributes to increased water temperature and increased nutrient and sediment loads in reservoirs and streams in the upper Klamath River basin.

Resulting lower streamflow and poor water quality may negatively affect listed species.

Poor water quality in upper Klamath basin and Klamath River is the result of cumulative effects in upper Klamath River basin that lead to nutrient enrichment. This poor water quality is independent of and unaffected by the proposed action. Additional cumulative effects in upper Klamath River basin negatively affecting suckers include: entrainment, introduced fishes, barriers to upstream passage, habitat loss, and habitat degradation.

Cumulative effects associated with the Klamath Project and discussed in Reclamation's Klamath Basin Project BA (2002) and NMFS' Klamath Basin Biological Opinion (2002) are included by reference.

In September 2002, the California Fish and Game Commission (Commission) voted to put northern California coho salmon on the state's threatened species list under the California Endangered Species Act (CESA). The area extends from Punta Gorda north to the Oregon state line. Although this CESA listing for coho salmon north of San Francisco and the associated take prohibitions and limitations will theoretically provide an added level of protection of these fish in the Klamath River basin, it is difficult to quantify the associated survival benefit.

The Commission recently established the Shasta-Scott Recovery Team (SSRT) as part of an effort to develop a recovery strategy for coho salmon in California. The SSRT represents a broad cross section of interests with the intent of developing a pilot program of recovery actions related to agriculture and agricultural water use in the Shasta and Scott River valleys. The pilot program will become part of a range-wide recovery strategy for coho salmon that will be presented to the California Fish and Game Commission by August 2003.

Until improvements in non-Federal land management practices are actually implemented, Reclamation assumes that future private and State actions will continue at similar intensities as in recent years.

7.3 Lost River and Shortnose Suckers

Much of the land in the Jenny Creek watershed is federally owned. Proposed federal actions that may affect listed species will undergo section 7 consultations and thus are not considered in this section. Remaining land is privately owned and is mostly forested with mixed conifers and grassland/meadow. Few people live in the area. Reclamation anticipates that most of the land will be used as it has in the past as range (grazing) and forest (logging).

Grazing in the Jenny Creek watershed may destabilize streambank vegetation resulting in erosion, siltation, reduced quality of spawning areas, increased water temperatures, wider and shallower stream channels, and lowered water tables. However, because endangered Lost River and shortnose suckers may only occupy the lower two miles of Jenny Creek for a short period of time for spawning, impacts are likely small. Conditions of rangelands are anticipated to continue to improve with local proactive management.

Forestry practices on private lands may also contribute to water quality declines in the Jenny Creek watershed (sedimentation, nutrient loading). Reclamation does not consider future forestry practices a major threat in this watershed because commercial forest comprises a small area, is located in the upper reaches of the watershed, and timber has been infrequently harvested.

Degraded water quality resulting from grazing and logging on private lands in the Jenny Creek watershed including increased temperatures, sediment, and nutrients are likely to have a small cumulative effect on water quality in Iron Gate Reservoir because of the small contribution of this tributary to the overall inflow from the Klamath River.

Introduced fishes found in the Jenny Creek watershed include: rainbow trout, golden shiner, brown bullhead, black crappie, largemouth bass, green sunfish, and pumpkinseed. They are likely to continue to persist in the watershed. However, most of these species already occupy Iron Gate Reservoir and are likely to continue to prey on and compete with endangered suckers.

Transportation of hazardous materials along roadways in the Jenny Creek watershed and use of herbicides and pesticides appear to be a small risk owing to their infrequent presence in the watershed.

7.4 Northern Spotted Owl

The loss of spotted owl habitat due to future timer harvest, land development, recreation, barred owl ranged expansion, and forest fires will continue to be problematic for this species recovery.

7.5 Bald Eagle

The bald eagle population appears to be rebounding in Oregon and in the Rogue Valley. However, timber harvest, land development, and especially increased recreation are factors working against bald eagle recovery.

7.6 Gentner's Fritillary

The species is threatened by a variety of factors including habitat loss associated with rapidly expanding residential and agricultural development (Federal Register 67:70452). Reclamation is unaware of any scheduled state, private, or other actions that would affect the species.

7.7 Vernal Pool Species

7.7.1 Factors Influencing Vernal Pools and Associated Species

Human population growth in Jackson County is occurring at an extremely fast rate; much of this growth, and the resulting development, is taking place near Medford and White City in the heart of the Agate Desert. Development in and around vernal pools will affect listed species dependent upon vernal pool habitat.

The Rogue Valley Council of Governments is leading an effort to develop a comprehensive Wetland Conservation Plan (WCP). Implementation of the WCP is dependent upon funding. The comprehensive WCP is designed to streamline permit requirements, minimize permitting costs, and provide certainty and consistency in permit conditions by adopting a clear standard for permit issuance. Under the WCP, USACE issues a Section 404, Special Area Management Plan permit and Oregon Division of State Lands issues a special wetland fill permit. In order to ensure that any habitat destruction allowed by the plan complies with ESA, the USFWS must review and approve the plan.

Vernal pool habitat will be affected as a result of implementation of the comprehensive WCP being developed by the Rogue Valley Council of Governments. The WCP designates vernal pool complex habitat areas into three resource categories:

- Development for areas earmarked for future development with expedited permitting
- Protection for areas to be reserved almost exclusively for habitat preservation
- Incentive for areas where existing and planned land uses are compatible with habitat conservation.

Of the 7,719 acres of original vernal pool complex habitat remaining in this area, 578 acres (7.5 percent) are currently designated development, 2,011 (26 percent) acres are designated protection, and 5,130 acres (66.5 percent) are designated incentive. This is likely a minimum estimate for vernal pool complexes that will be lost to development activities over the next decade (Cam Patterson 9/5/2001, pers. comm.).

7.7.2 Large-Flowered Woolly Meadowfoam

Vernal pool habitat, and hence large-flowered woolly meadowfoam habitat, will be affected as a result of implementation of the comprehensive WCP being developed by the Rogue Valley Council of Governments.

Of the 3,129 acres of large-flowered woolly meadowfoam habitat remaining in the Agate Desert, 61 acres (1.9 percent) are in the development category, 1,708 acres (54.6 percent) are in the protection category, and 1,360 acres (43.5 percent) are in the incentive category. The 61 acres slated for development would likely be permanently lost and the fate of the 1,360 acres in the incentive category may depend on funding of conservation incentive programs. Because the WCP is in draft form at this time, these acreage figures are preliminary.

7.7.3 Cook's Lomatium

Vernal pool habitat, and hence Cook's lomatium habitat, will be affected as a result of implementation of the comprehensive Wetland Conservation Plan being developed by the Rogue Valley Council of Governments.

Of the 2,127 acres of Cook's lomatium habitat remaining in the Agate Desert, 130 acres (6.1 percent) are in the development category, 1,468 acres (69 percent) are in the protection category, and 529 acres (24.9 percent) are in the incentive category. Because the WCP is in draft form at this time, these acreage figures are preliminary.

7.7.4 Vernal Pool Fairy Shrimp

Vernal pool habitat, and hence vernal pool fairy shrimp, will be affected as a result of implementation of the comprehensive WCP being developed by the Rogue Valley Council of Governments.

Of the 3,591 acres of vernal pool fairy shrimp habitat remaining in the Agate Desert, 79 acres (2.2 percent) of are in the development category, 1,694 acres (47.2 percent) are in the protection category, and 1,818 (50.6 percent) are in the incentive category. The 79 acres slated for development would likely be permanently lost and the fate of the 1,818 acres in the Incentive category may depend on funding of conservation incentive programs. Because the WCP is in draft form at this time, these acreage figures are preliminary.

8.0 Essential Fish Habitat Assessment for Bureau of Reclamation Rogue River Basin Project Operations

8.1 Action Agency

Bureau of Reclamation, Pacific Northwest Region, Lower Columbia Area

8.2 Project Name

Continued Operation and Maintenance of the Rogue River Basin Project Talent Division, Oregon

8.3 Essential Fish Habitat Background

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) mandates Federal action agencies which fund, permit, or carry out activities that may adversely impact the essential fish habitat (EFH) of federally-managed fish species to consult with the National Marine Fisheries Service (NMFS) regarding the potential adverse effects of their actions on EFH (Section 305 (b)(2)). §Section 600.920(a)(1) of the EFH final regulations state that consultations are required of Federal action agencies for renewals, reviews, or substantial revisions of actions if the renewal, review, or revision may adversely affect EFH. The EFH regulations require that Federal action agencies obligated to consult on EFH also provide NMFS with a written assessment of the effects of their action on EFH (50 CFR § 600.920). Under Appendix A of Amendment 14 to the Pacific Coast Salmon Fishery Management Plan (PFMC, 1999), the Pacific Fisheries Management Council has identified and described EFH for SONCC Chinook salmon and SONCC coho salmon in the middle Rogue River HUC and upper Klamath River HUC within the proposed action area. The statute also requires Federal action agencies receiving NMFS EFH Conservation Recommendations to provide a detailed written response to NMFS within 30 days upon receipt detailing how they intend to avoid, mitigate or offset the impact of the activity on EFH (Section 305(b)(4)(B)).

The objective of this EFH assessment is to describe potential adverse effects to designated EFH for federally-managed fisheries species within the proposed action area. It also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

8.4 Identification of Essential Fish Habitat

The geographic extent of freshwater EFH for the Pacific salmon fishery is proposed as waters currently or historically accessible to salmon within specific U.S. Geological Survey hydrologic units (PFMC 1999). For the Rogue River Basin Project (Project), the aquatic areas identified as EFH for SONCC Chinook salmon and SONCC coho salmon are within the designated critical habitat for coho salmon (Figure 4-1). This includes:

1. Bear Creek and its tributaries downstream from Emigrant Dam (Rogue River basin);
2. The entire Little Butte Creek drainage downstream from Fish Lake Dam on North Fork Little Butte Creek and Agate Dam on Antelope Creek (Rogue River basin); and
3. Klamath River and its tributaries downstream from Iron Gate Dam (Klamath River basin) (PFMC 1999).

Essential fish habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Reclamation's proposed operation is described in Chapter 2 of the BA for the Project. Chapter 6 of the BA addresses impacts to the threatened Northern California/ Southern Oregon ESU coho salmon (*Oncorhynchus kisutch*), listed as threatened under the Endangered Species Act (ESA). These impacts include adverse effects to the habitat conditions required by coho salmon and which are also identified EFH as provided by the Magnuson-Stevens Act. The Rogue River and Klamath River basins also provide EFH to SONCC Chinook salmon (*O. tshawytscha*), which are covered under the EFH provisions of Magnuson-Stevens Act but are not listed under the ESA. This EFH consultation addresses both species but also refers the reader to more specific information pertaining to the habitat requirements of coho salmon contained in the BA.

8.5 Essential Fish Habitat Requirements for Chinook Salmon and Coho Salmon

Chinook: General life history information for Chinook salmon is summarized below. Further detailed information on Chinook salmon is available in the NMFS status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers et al. 1998), and the NMFS proposed rule for listing several ESUs of Chinook salmon (NMFS 1998).

The Rogue River and Klamath River basins contain populations of spring-run and fall-run Chinook (Campbell and Moyle 1990, Healey 1991; Vogt, personal communication). Within these basins, there are statistically significant, but fairly modest, genetic differences between the fall and spring runs. The majority of spring- and fall-run fish emigrate to the marine environment primarily as subyearlings, but have a significant proportion of yearling smolts. These Chinook salmon populations all exhibit an ocean-type life history. The majority of fish emigrate to the ocean as subyearlings, although yearling smolts can constitute up to approximately a fifth of outmigrants. However, the proportion of fish which smolt as sub-yearling versus yearling varies from year to year (Snyder 1931, Schluchter and Lichatowich 1977, Nicholas and Hankin 1988, Barnhart 1995). This fluctuation in age at smoltification is more characteristic of an ocean-type life history.

Coho: General life history information for coho salmon is provided in the BA (Chapter 3) and further information is available in the status review (Weitkamp et al. 1995). Primarily, adult and juvenile coho salmon are observed in tributaries and main stems of Bear Creek, Little Butte Creek, and the Klamath River downstream from Iron Gate Dam.

8.5.1 Adult Immigration and Spawning

Chinook*:* Run timing for spring-run Chinook salmon in the Klamath River typically begins in March and continues through August, with peak migration occurring in May and June (Table 8-1). Hardy and Addley (2001) noted that spring Chinook can enter as early as February. Run timing for fall-run Chinook salmon varies depending on the size of the river. In the lower reaches of the Klamath River, fall-run freshwater entry begins later in October, with peak spawning in late November and December– often extending into January (Leidy and Leidy 1984, Nicholas and Hankin 1988, Barnhart 1995). Late-fall or "snow" Chinook salmon from Blue Creek, on the lower Klamath River, were described as resembling the fall-run fish from the Smith River in run and spawning timing, as well as the degree of sexual maturation at the time of river entry (Snyder 1931).

Table 8-1. Summary of timing for key salmon life history events related to EFH.

	Adult Immigration	Spawning	Smolt Emigration
Spring run Chinook	Feb. – Aug.	Late Aug - Sept. peak in Sept.	March - July
Fall run Chinook	Aug. - Sept.	Sept. - early Jan.	April - June
Late-fall run	Nov.- Dec. but may be as late as Feb.	Unavailable	Unavailable
Coho salmon	Sept. - December	Nov. - March	April - July with peak in May

In the Rogue River basin, adult spring Chinook migrate upstream past Gold Ray Dam before August 15; fall Chinook pass this point after August 15 (Vogt, personal communication). Fall Chinook salmon have been observed by the Oregon Department of Fish and Wildlife (ODFW) as far upstream as river mile 23 in Bear Creek; about 4 miles downstream from the confluence of Walker and Emigrant creeks (Vogt, personal communication). Fall Chinook spawning in Bear Creek occurs in November and December. Little spawning habitat occurs in Emigrant Creek downstream from Emigrant Dam. Spring Chinook have been observed about 1.5 miles upstream in South Fork Little Butte Creek. Fall Chinook spawn up to the confluence of North and South Fork Little Butte creeks (Vogt, personal communication). Chinook salmon probably do not spawn very much in Antelope Creek due to its small size.

All Chinook stocks utilize resting pools as they migrate upstream (Myers et al. 1998). As noted in Myers et al. (1998), these pools provide an energetic refuge from river currents, a thermal refuge from high summer and autumn temperatures, and a refuge from potential predators (Berman and Quinn 1991, Hockersmith et al. 1994). Furthermore, the utilization of resting pools may maximize the success of the spawning migration through decreases in metabolic rate and the potential reduction in susceptibility to pathogens (Bouck et al. 1975, Berman and Quinn 1991).

Spawning for spring run Chinook salmon may occur from September through mid - November (Hardy and Addley 2001) and can peak in September (Myers et al. 1998).

Historically, spring-run spawning areas were located in the river headwaters (generally above 400 m). Spawning for fall-run Chinook begins in September through early January.

Coho: In general, river entry and spawn timing showed considerable spatial and temporal variability. Most coho salmon enter rivers between September and February and spawn from November to January (Hassler 1987), and occasionally into February and March (Weitkamp et al. 1995).

8.5.2 Spawning Habitat

Chinook: Chinook salmon spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths greater than 6 inches, usually 1-3 feet to 10-15 feet. Preferred spawning substrate is clean and loose, medium to large-sized gravel. Hardy and Addley (2001) report that Chinook also use small cobble substrate. Physical habitat modeling indicates that spawning habitat is maximized at approximately 1,300 cfs in the Klamath River between Iron Gate Dam and Shasta River during the October - February time frame (Hardy and Addley 2001). Similar data do not exist for the Rogue River, Bear Creek, or Little Butte Creek. Egg incubation generally occurs from 40-60 days with alevins and fry remaining in the gravel between 2 - 4 weeks and emerging during December. Hardy and Addley (2001) reported that suitable incubation temperatures were assumed to be between approximately 5 °C (41 °F) and 14 °C (57 °F) as significant mortality occurs beyond this range.

Coho: In general, earlier migrating fish spawn farther upstream within a basin than later migrating fish, which enter rivers in a more advanced state of sexual maturity (Sandercock 1991). Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools with suitable water depth and velocity.

Coho salmon eggs incubate for approximately 35 to 50 days between November and March. The duration of incubation may change depending on ambient water temperatures (Shapovalov and Taft 1954). Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity.

8.5.3 Rearing Habitat

Chinook: At the time of emergence from their gravel nests, most fry disperse downstream towards the estuary, hiding in the gravel or stationing in calm, shallow waters with fine sediment substrates and riparian bank cover such as tree roots, logs, and submerged or overhead vegetation. As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, submerged aquatic vegetation, logs, riparian vegetation, and undercut banks provide food, shade and protect juveniles from predation. Chinook salmon in the Southern Oregon and California Coastal ESU exhibit an ocean-type life history, that is, they typically migrate to seawater in their first year of life (NMFS 1998). However, when environmental conditions are not conducive to subyearling emigration, ocean-type Chinook salmon may remain in freshwater for their entire first year (NMFS 1998).

The fish rear in calm, marginal areas of the river, particularly back eddies, behind fallen trees, near undercut tree roots or over areas of bank cover, and emigrate as smolts from April through June. Hardy and Addley (2001) noted that Chinook fry utilized habitat along the stream margins in association with cover versus the use of the main river channel. The authors also noted that a relatively small proportion of Chinook fry were found associated with substrate specific cover compared to inundated streamside vegetation cover types at depths less than 2 feet. This association with shallow, vegetative escape cover indicates the importance of riparian habitat to the early life history stage of juvenile Chinook.

Principal foods of Chinook while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia,* flies, gnats, mosquitoes or copepods (Kjelson et al. 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938) as well as other estuarine and freshwater invertebrates.

Coho: Fry start emerging from the gravel two to three weeks after hatching (Hassler 1987). Following emergence, fry move into shallow areas near the stream banks. As coho salmon fry grow larger, they disperse upstream and downstream and establish and defend a territory (Hassler 1987).

During the summer, coho salmon fry prefer pools featuring adequate cover such as large woody debris, undercut banks, and overhanging vegetation. Juvenile coho salmon prefer to over-winter in large main stem pools, backwater areas and secondary pools with large woody debris, and undercut bank areas (Hassler 1987, Heifetz et al. 1986). Juveniles primarily eat aquatic and terrestrial insects (Sandercock 1991).

Coho salmon typically rear in fresh water for up to 15 months, then migrate to the sea as smolts between March and June (Weitkamp et al. 1995).

8.6 Potential Adverse Effects of Proposed Project

As described in the BA, the proposed action can adversely affect coho salmon by decreasing survival and abundance of several freshwater life history stages of coho, including fry, juveniles, and outmigrating smolts. Although adult coho may be adversely affected by the proposed action in the Rogue River basin, adverse effects to the EFH of Chinook salmon may be greater due to their greater reliance on Little Butte Creek and Bear Creek mainstem habitat and less on tributaries. However, the following summarizes the adverse affects to EFH for both species. Minimal impact is expected in the Klamath River with the minor transbasin diversion under Reclamation's control.

During October through March, the proposed action could adversely affect the EFH function of providing passage conditions for upstream migrating salmon and their spawning success in the Bear Creek and Little Butte Creek drainages. Reclamation-owned diversion structures (i.e. Antelope Creek, Ashland, Oak Street, and Phoenix) all meet NMFS fish protection criteria. However, some Reclamation-owned canals that cross tributaries to Little Butte Creek and Bear Creek (see Tables 4-9, 4-10, and 4-11) likely cause adult fish migration delays and juvenile losses where they do not meet NMFS fish protection criteria.

Spring flows in the main stems and tributaries of Bear Creek and Little Butte Creek provide important EFH that supports rearing functions. During spring months, the proposed action will reduce flows which will adversely affect salmon fry rearing for individuals either originating from the main stems or migrating down from tributaries. Because the amount of suitable EFH in the stream channels is related to the amount of flow for rearing salmon, salmon fry may be adversely affected if sufficient flows are not maintained at appropriate levels. The survival of Chinook salmon fry that cannot find suitable rearing EFH will most likely be adversely affected, thereby resulting in reduced numbers of salmon.

As noted in the section on rearing habitat, much of the salmon rearing is associated with riparian corridors. The riparian zone acts as the interface between terrestrial and aquatic ecosystems by moderating the effects of upslope processes and provides important ecological functions including bank stabilization, nutrient cycling, food-web support, and important stream microclimate and shading functions (Spence et al.

1996, Flosi et al. 1998, NRC 2002). Riparian vegetation, including shaded riverine aquatic (SRA) cover, provides juvenile salmon cover from predators, increases habitat complexity, provides a source of insect prey and provides shade for maintaining water temperatures within suitable ranges for all life stages. The functional values of riparian corridors and the benefits they provide to stream fish populations are well documented (Karr and Schlosser 1978, Wesche et al. 1987, Gregory et al. 1991, Caselle et al. 1994, Wang et al. 1997). As noted by the NRC (2002), the reintroduction or maintenance of the full range of flow regimes to mimic the natural hydrograph, in addition to minimum stream flow, is essential for restoring and sustaining, respectively, healthy riparian systems. The proposed action may result in flows that frequently create conditions that effectively separate much of the riparian zone from the waters of the river, thereby limiting the function of the riparian zone.

In addition to supporting important riparian habitat functions, springtime high flows also facilitate the outmigration of salmon smolts. Although specific relationships between Bear Creek and Little Butte Creek flows and smolt survival have not been established, information from other locations indicates a positive relationship between smolt survival and river flows. Thus, the proposed action will likely affect coho and Chinook smolt survival because of reduced flows.

Adverse effects to EFH will also result from reductions in water quality (e.g., water temperatures). While the relationship between flows and water temperature is poorly understood, the BA concluded that Project irrigation withdrawal at Reclamation-owned diversion dams in Little Butte Creek and Bear Creek removes a majority of the flow and is a contributing factor to water temperatures exceeding the Oregon standard. Minimal adverse effects would occur in stream temperatures in the Klamath River with Rogue River Basin Project-related flow depletions.

8.7 Essential Fish Habitat Conservation Measures

Water conservation and water quality improvement projects contribute to Bear Creek watershed water quality improvements. These projects will continue into the future. An investigation should be conducted to establish which Bear Creek Project diversions and canals that cross tributaries owned by Reclamation warrant corrective fish passage actions. In addition, streamflow requirements of coho and Chinook salmon need to be quantified in the Little Butte Creek and Bear Creek systems that would allow a better prediction of the effects of Federal water operations on stream fish habitat. Additional conservation measures will be developed at the completion of consultation.

8.8 Conclusion

Upon review of the effects, Reclamation's continued operation and maintenance will adversely affect the spawning, rearing and migratory EFH functions of Pacific salmon currently or previously managed under the Magnuson-Stevens Act in Bear Creek and Little Butte Creek and their tributaries. The proposed action would result in a continued decline in EFH conditions in the Rogue River basin over time, and thereby preclude rebuilding of the SONCC coho salmon population and reduce the habitat required to support a sustainable Chinook fishery. Minimal impact to EFH is expected to occur in the Klamath River.

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— APPENDIX A—

Species List

United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
Lower Columbia Area Office
825 NE Multnomah Street, Suite 1110
Portland, Oregon 97232-2135

IN REPLY REFER TO:

PN-6540
ENV-7.00

AUG 23 2000

MEMORANDUM

To: State Supervisor, U.S. Fish and Wildlife Service
2600 SE 98th Avenue, Suite 100, Portland OR 97266

From: J. Eric Glover
Area Manager

Subject: Request for List of Threatened and Endangered Species - Endangered Species Section 7 - Bureau of Reclamation's Rogue River Basin Project, Talent Division, OR

The Bureau of Reclamation (Reclamation) is proposing to enter into Section 7 consultation regarding the operation and maintenance of irrigation facilities within Reclamation's Rogue River Basin Project, Talent Division. The facilities included in this consultation are operated and maintained by the Talent, Medford and Rogue River Valley irrigation districts. Irrigated lands served by these districts are located in and around the Medford area and total about 35,000 acres. There are an extensive network of reservoirs, canals, and diversion facilities utilized to bring water to the districts' irrigated crop lands.

Many of the facilities currently used by the Talent, Medford and Rogue River Valley districts were originally constructed in the early 1900's by private parties. The Federal government became involved in the 1950's and 60's when Congress authorized Reclamation to conduct rehabilitation, enlargement, and extension of the existing water diversion and delivery facilities. A general description of the three districts, including facilities discussion, development history, and project benefits, is attached. A facilities location map is also included for your information.

Operation of the three irrigation districts along with a large component of non Federal irrigation in the Rogue River basin, affect stream flows. These effects will be described in the biological assessment to the extent possible. Since the project lands and water delivery facilities are spread over an expansive area of the Little Butte Creek and Bear Creek drainages (Rogue basin) and the upper Klamath basin drainages, we ask that your ESA species list cover the townships listed below, recognizing that the project features actually encumber a much reduced land and water area as shown on the location map. Project features of the three districts encompass parts of the following townships:

Jackson County: <u>T36S</u>: R2W, R1W, R1E, R2E, R4E
<u>T37S</u>: R2W, R1W, R4E
<u>T38S</u>: R2W, R1W, R1E, R3E, R4E
<u>T39S</u>: R1W, R1E, R2E, R3E, R4E
<u>T40S</u>: R2E, R3E

Klamath County: <u>T36S</u>: R5E

We are sending a similar ESA species list request to the Ecosystem Restoration Office in Klamath Falls. We would appreciate receiving the ESA species list at your earliest possible convenience. Please send your response and any other correspondence related to this request to me at the above address with a copy to: Bureau of Reclamation, Attention-PN 6540, 1150 North Curtis Road, Suite 100, Boise ID, 83706-1234. If you have any question during the course of this review, please contact Mr. Richard Prange at (208) 378-5031.

Sincerely,

J. Eric Glover
Area Manager

Attachments - 2

bc: PN-6540, BFO-6100
(w/attachments)

United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
Lower Columbia Area Office
825 NE Multnomah Street, Suite 1110
Portland, Oregon 97232-2135

IN REPLY REFER TO:

PN-6540
ENV-7.00

AUG 23 2000

MEMORANDUM

To: Project Leader, Ecosystem Restoration Office, U.S. Fish and Wildlife Service
6600 Washburn Way, Klamath Falls OR 97603

From: Eric Glover
Area Manager

Subject: Request for List of Threatened and Endangered Species - Endangered Species Section 7 - Bureau of Reclamation's Rogue River Basin Project, Talent Division, OR

The Bureau of Reclamation (Reclamation) is proposing to enter into Section 7 consultation regarding the operation and maintenance of irrigation facilities within Reclamation's Rogue River Basin Project, Talent Division. The facilities included in this consultation are operated and maintained by the Talent, Medford and Rogue River Valley irrigation districts. Irrigated lands served by these districts are located in and around the Medford, Oregon area and total about 35,000 acres. There are an extensive network of reservoirs, canals, and diversion facilities utilized to bring water to the districts' irrigation crop lands. Some of these facilities are located in the Klamath Basin and some project water is conveyed by transbasin transfer to the Rogue River Basin Project.

Many of the facilities currently used by the Talent, Medford and Rogue River Valley districts were originally constructed in the early 1900's by private parties. The Federal government became involved in the 1950's and 60's when Congress authorized Reclamation to conduct rehabilitation, enlargement, and extension of the existing water diversion and delivery facilities. A general description of the three districts, including facilities discussion, development history, and project benefits, is attached. A facilities location map is also included for your information.

There are two streams in the Klamath River drainage where runoff is captured in reservoirs for irrigation use in the Rogue River basin. Fourmile Creek drains naturally into Upper Klamath Lake. It is impounded by Fourmile Dam and the stored water is moved across the Cascade Range divide for use by the Medford and Rogue River Valley ID's. Likewise, Howard Prairie and Hyatt reservoirs store runoff in the upper Jenny Creek drainage. This storage is conveyed across the divide for use by the Talent ID. Jenny Creek flows into Iron Gate Reservoir on the Klamath River.

As a result of these transbasin water transfers, we are requesting that your office provide a listing of ESA species found in the Klamath basin that could potentially be affected. We would appreciate receiving the subject list at your earliest possible convenience. Please send your response and any other correspondence related to this request to me at the above address with a copy to: Bureau of Reclamation, Attention-PN 6540, 1150 North Curtis Road, Suite 100, Boise ID, 83706-1234. If you have any questions during the course of this review, please contact Mr. Richard Prange at (208) 378-5031.

Sincerely,

Eric Glover

J. Eric Glover
Area Manager

Attachments - 2

bc: PN-6540, BPO-6100 (all wo/attachment)
Mark Buettner, Klamath Basin Area Office (w/attachments)

United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
Lower Columbia Area Office
825 NE Multnomah Street, Suite 1110
Portland, Oregon 97232-2135

IN REPLY REFER TO:

PN-6540
ENV-7.00

AUG 23 2000

Mr. Garth Griffin
Protected Species Branch
National Marine Fisheries Service
525 NE Oregon Street, Suite 500
Portland, OR 97232

Subject: Request for List of Threatened and Endangered Species - Endangered Species Act, Section 7 - Bureau of Reclamation's Rogue River Basin Project, Talent Division, OR

Dear Mr. Griffin,

The Bureau of Reclamation (Reclamation) is proposing to enter into Section 7 consultation regarding the operation and maintenance of irrigation facilities within Reclamation's Rogue River Basin Project, Talent Division. The facilities included in this consultation are operated and maintained by the Talent, Medford and Rogue River Valley irrigation districts. Irrigated lands served by these districts are located in and around the Medford area and total about 35,000 acres. There are an extensive network of reservoirs, canals, and diversion facilities utilized to bring water to the districts' irrigated crop lands.

Many of the facilities currently used by the Talent, Medford, and Rogue River Valley districts were originally constructed in the early 1900's by private parties. The Federal government became involved in the 1950's and 60's when Congress authorized Reclamation to conduct rehabilitation, enlargement, and extension of the existing water diversion and delivery facilities. A general description of the three districts, including facilities discussion, development history, and project benefits, is attached. A facilities location map is include for your information.

Operation of the three irrigation districts along with a large component of non Federal irrigation in the Rogue River basin affects, stream flow conditions. These effects will be described in a biological assessment using the best information available and to the extent possible. Project lands and water conveyance facilities are spread over an expansive area of the Little Butte Creek and Bear Creek drainages (Rogue basin). Some project reservoir storage and transbasin diversion facilities are also located on the east side of the Cascade divide and impact stream flows in Fourmile Creek and Jenny Creek (Klamath River basin).

We are requesting that your office provide a listing of ESA anadromous fish species found in the Rogue River basin. Regarding the Klamath River basin, we are sending a similar request to the National Marine Fisheries Service field office in Arcata, California. We anticipate the list of species to include:

Southern Oregon/Northern California Coasts coho ESU (threatened)
Klamath Mountains Province steelhead ESA (candidate)

We would appreciate receiving your confirmation or adjustments to this list at your earliest possible convenience. Please send your response and any other correspondence related to this request to me at the above address with a copy to: Bureau of Reclamation, Attention: PN 6540, 1150 North Curtis Road, Suite 100, Boise ID, 83706-1234. If you have any questions during the course of this review, please contact Mr. Richard Prange at (208) 378-5031.

Sincerely,

Eric Glover

J. Eric Glover
Area Manager

Enclosures - 2

bc: PN-6540, BFO-6100 (all wo/encls)

United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
Lower Columbia Area Office
825 NE Multnomah Street, Suite 1110
Portland, Oregon 97232-2135

IN REPLY REFER TO:

PN-6540
ENV-7.00

AUG 23 2000

Ms. Rebecca Lent
Regional Administrator
National Marine Fisheries Service, Southwest Region
501 West Ocean Blvd.
Long Beach, CA 90802- 4213

Subject: Request for List of Threatened and Endangered Species - Endangered Species Act, Section 7 - Bureau of Reclamation's Rogue River Basin Project, Talent Division, OR

Dear Ms. Lent,

The Bureau of Reclamation (Reclamation) is proposing to enter into Section 7 consultation regarding the operation and maintenance of irrigation facilities within Reclamation's Rogue River Basin Project, Talent Division. The facilities included in this consultation are operated and maintained by the Talent, Medford and Rogue River Valley irrigation districts. Irrigated lands served by these districts are located in and around the Medford area and total about 35,000 acres. There are an extensive network of reservoirs, canals, and diversion facilities utilized to bring water to the districts' irrigated crop lands.

Many of the facilities currently used by the Talent, Medford, and Rogue River Valley districts were originally constructed in the early 1900's by private parties. The Federal government became involved in the 1950's and 60's when Congress authorized Reclamation to conduct rehabilitation, enlargement, and extension of the existing water diversion and delivery facilities. A general description of the three districts, including facilities discussion, development history, and project benefits, is attached. A facilities location map is include for your information.

Operation of the three irrigation districts along with a large component of non Federal irrigation in the Rogue River basin affects, stream flow conditions. These effects will be described in a biological assessment using the best information available and to the extent possible. Project lands and water conveyance facilities are spread over an expansive area of the Little Butte Creek and Bear Creek drainages (Rogue basin). Some project reservoir storage and transbasin diversion facilities are also located on the east side of the Cascade divide and impact stream flows in Fourmile Creek and Jenny Creek (Klamath River basin).

We are requesting that your office provide a listing of ESA anadromous fish species found in the Klamath River basin. Regarding the Rogue River basin, we are sending a similar request to the National Marine Fisheries Service office in Portland. We anticipate the list of species to include:

Southern Oregon/Northern California Coasts coho ESU (threatened)
Klamath Mountains Province steelhead ESA (candidate)

We would appreciate receiving your confirmation or adjustments to this list at your earliest possible convenience. Please send your response and any other correspondence related to this request to me at the above address with a copy to: Bureau of Reclamation, Attention: PN 6540, 1150 North Curtis Road, Suite 100, Boise ID, 83706-1234. If you have any questions during the course of this review, please contact Mr. Richard Prange at (208) 378-5031.

Sincerely,

Eric Glover

J. Eric Glover
Area Manager

Enclosures - 2

cc: Lrma Lagomarsino
National Marine Fisheries Service
1655 Heindoon Rd.
Arcata, CA 95521
(w/encls)

bc: PN-6540, BPO-6100 (all wo/encls)
Mark Buettner, Klamath Falls Area Office (w/encls)

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region
501 West Ocean Blvd., Suite 4200
Long Beach, CA 90802
(562) 980-4000; Fax (562) 980-4018

KRP

BUREAU OF

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September 12, 2000

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J. Eric Glover 18258
Bureau of Reclamation
Lower Columbia Area Office
825 NE Multnomah Street, Suite 1110
Portland, Oregon 97232-2135

Dear Mr. Glover:

Thank you for your letter of August 28, 2000 regarding the presence of Federally listed (or proposed/candidate for listing) threatened or endangered species in the Klamath River basin, and critical habitat in the Klamath River basin that may be affected by the Bureau of Reclamation's Rogue River Basin Project.

Available information indicates that the following species may occur downstream of Irongate Dam on the Klamath River, which is downstream of the project area:

> **Southern Oregon/Northern California ESU coho salmon** *(Oncorhynchus kisutch)* - threatened
>
> **Klamath Mountains Province ESU steelhead** (*Oncorhynchus mykiss*) - candidate

Critical habitat for the Southern Oregon/Northern California ESU coho salmon extends on the Klamath River as far upstream as the Irongate Dam.

The U.S. Fish and Wildlife Service (USFWS) may also have listed species or critical habitat under its jurisdiction in the project area. Please contact Mr. Greg Goldsmith, 1655 Heindon Road, Arcata, CA, 95521, or (707) 825-5120, regarding the presence of listed species or critical habitat under USFWS jurisdiction that may be affected by your project.

If you have questions concerning these comments, please contact Mr. Mike Kelly at (707) 825-5178.

Sincerely,

for Vince Tagliamonti
Rebecca Lent, Ph.D.
Regional Administrator

cc: ✓ Bureau of Reclamation
Attention: PN 6540
1150 North Curtis Road, Suite 100
Boise, Idaho 83706-1234

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Klamath Falls Fish & Wildlife Office
6610 Washburn Way
Klamath Falls, OR 97603
(541)885-8481 FAX: (541)885-7837

SEP 25 2000

1000 9/27
6100 copy faxed
9/25/00

September 22, 2000

Memorandum

In reply refer to 1-10-00-SP-165

To: J. Eric Glover, Bureau of Reclamation, 825 NE Multnomah Street, Suite 1110, Portland, Oregon 97232-2135

From: Field Supervisor, Klamath Falls Fish and Wildlife Office, Klamath Falls, Oregon

Subject: Species List for Klamath County, Oregon

This letter responds to your request for information on listed and proposed endangered and threatened species that may occur in the vicinity of the Bureau of Reclamation's Rogue River Basin Project.

The Klamath River Basin portion of the proposed project area falls within the jurisdiction of the Klamath Falls Fish and Wildlife Office and the Rogue River Basin portion falls within the jurisdiction of the Oregon State Office. Therefore, coordination needs to continue between our offices for your consultation needs under section 7 of the Endangered Species Act (Act) and we can also assist in other issues relating to our trust resources.

We have enclosed a species list for Klamath County, Oregon, and the list fulfills the requirements of the Service under section 7(c) of the Act. A similar letter from the Oregon State Office will cover the Rogue River Basin area of the proposed project area. If the subject project may affect a listed species and the proposed action is funded, permitted, or implemented by a Federal agency, the Federal agency must prepare a biological assessment if the project is a construction project which may require an environmental impact statement [1/]. If a biological assessment is not required, the Federal agency still has the responsibility to review its proposed activities and determine whether the listed species may be affected.

During the assessment or review process, the Federal agency may engage in planning efforts, but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Act. If a listed species may be affected, the Federal agency should request, in writing through our offices, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to listed species prior to a written request for formal consultation.

Federal agencies are required to confer with the Service, pursuant to section 7(a)(4) of the Act, when an agency action is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat (50 CFR 402.10(a)). A request for formal conference must be in writing and should include the same information that would be provided for a request for formal consultation. Conferences can also include discussions between the Service and the Federal agency to identify and resolve potential conflicts between an action and proposed species or proposed critical habitat early in the decision-making process. The Service recommends ways to minimize or avoid adverse effects of the action. The conference process fulfills the need to inform Federal agencies of possible steps that an agency might take at an early stage to adjust its actions to avoid jeopardizing a proposed species.

The Bureau of Reclamation should be aware that section 9 of the Act prohibits the "take" of any listed species. The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. "Harm" in the definition of 'take' in the Act means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3)." Anyone who engages in a take would be subject to prosecution under section 9 of the Act. Such taking may occur only under the authority of the Service pursuant to section 7 (if a Federal agency is involved with this project) or through a section 10(a)(1)(B) permit, as mandated in the Act.

If you have any questions, please contact Leonard LeCaptain of my staff at (541) 885-8481 (Klamath Basin), Scott Center of the Roseburg Fish and Wildlife Office at (541) 957-3472 (Rogue Basin), or Cindy Bright of the Oregon State Office at (503) 231-6179 (Rogue Basin).

Sincerely,

Steven Alan Lewis
Field Supervisor

cc: USFWS-CNO, Attn: John Engbring
USFWS-Roseburg, Attn: Scott Center
USFWS-Portland, Attn: Cindy Bright
ODFW-Klamath Falls, Attn: Roger Smith and Ron Anglin
Klamath Tribes, Attn: Rick Ward

[1] "Construction Project" means any major Federal action which significantly affects the quality of the human environment designed primarily to result in the building or erection of man-made structures such as dams, buildings, roads, pipelines, channels and the like. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorizations or approval which may result in construction. In October of last year you received a list of Federally threatened, endangered and proposed species that may be present in Crater Lake National Park. That list was valid for 90 days or until we sent a memorandum with any changes that occurred. This memorandum is to inform you that no changes have occurred since you received the last list. Attached you will find another copy of the list with a current compilation date that reflects this change. In April you will receive another memorandum updating the existing species list.

Attachments

LISTED, PROPOSED AND CANDIDATE SPECIES THAT MAY OCCUR IN KLAMATH COUNTY, OREGON

LISTED SPECIES

Mammals

Canada lynx, *Lynx canadensis* (T)

Birds

Bald eagle, *Haliaeetus leucocephalus (T)*
Northern spotted owl, *Strix occidentalis caurina (T)* (CH)

Fish

Shortnose sucker, *Chasmistes brevirostris* (E) (PCH)
Lost River sucker, *Deltistes luxatus (E)* (PCH)
Bull trout, *Salvelinus confluentus* (T)

Plants

Applegate's milk vetch, *Astragalus applegatei (E)*

PROPOSED SPECIES

None

CANDIDATE SPECIES

Amphibians

Oregon spotted frog, *Rana pretiosa* (C)

Key to Federal Threatened and Endangered Species and Species of Concern Lists

(E)--Endangered, (T)--Threatened (P)--Proposed (C)--Candidate,
(CH)--Critical Habitat (PCH)--Proposed Critical Habitat (PT)--Proposed Threatened
(PE)--Proposed Endangered

updated September 2000

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3000		

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon State Office
2600 S.E. 98th Avenue, Suite 100
Portland, Oregon 97266
(503) 231-6179 FAX: (503) 231-6195

Reply To: 8330.6341(00)
File Name: Sp634.wpd

September 28, 2000

Cy to 6500
6540

J. Eric Glover
U.S. Bureau of Reclamation
825 NE Multnomah Street, Suite 1110
Portland, OR 97232-2135

Subject: Rogue River Basin Project (1-7-00-SP-634).

Dear Mr. Glover:

This is in response to your memorandum, dated August 23, 2000, requesting information on listed and proposed endangered and threatened species that may be present within the area of the Rogue River Basin Project in Jackson and Klamath Counties. A separate list will be sent from the Klamath Falls Fish and Wildlife office in response to the Klamath county area of the project. The U.S. Fish and Wildlife Service (Service) received your letter on August 24, 2000.

We have attached a list (Attachment A) of threatened and endangered species that may occur within the area of the Rogue River Basin Project. The list fulfills the requirement of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). U.S. Bureau of Reclamation (BR) requirements under the Act are outlined in Attachment B.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems on which they depend may be conserved. Under section 7(a)(1) and 7(a)(2) of the Act and pursuant to 50 CFR 402 *et seq.*, BR is required to utilize their authorities to carry out programs which further species conservation and to determine whether projects may affect threatened and endangered species, and/or critical habitat. A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) which are major Federal actions significantly affecting the quality of the human environment as defined in NEPA (42 U.S.C. 4332 (2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to the Biological Assessment be prepared to determine whether they may affect listed and proposed species. Recommended contents of a Biological Assessment are described in Attachment B, as well as 50 CFR 401.12.

If BR determines, based on the Biological Assessment or evaluation, that threatened and endangered species and/or critical habitat may be affected by the project, BR is required to consult with the Service following the requirements of 50 CFR 402 which implement the Act.

Attachment A includes a list of candidate species under review for listing. The list reflects changes to the candidate species list published October 25, 1999, in the Federal Register (Vol. 64, No. 205, 57534) and the addition of "species of concern." Candidate species have no protection under the Act but are included for consideration as it is possible candidates could be listed prior to project completion. Species of concern are those taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.

If a proposed project may affect candidate species or species of concern, BR is not required to perform a Biological Assessment or evaluation or consult with the Service. However, the Service recommends addressing potential impacts to these species in order to prevent future conflicts. Therefore, if early evaluation of the project indicates that it is likely to adversely impact a candidate species or species of concern, BR may wish to request technical assistance from this office.

Your interest in endangered species is appreciated. The Service encourages BR to investigate opportunities for incorporating conservation of threatened and endangered species into project planning processes as a means of complying with the Act. If you have questions regarding your responsibilities under the Act, please contact Scott Center at (541) 957-3472, or Cindy Bright at (503) 231-6179. For questions regarding anadromous fish, please contact National Marine Fisheries Service, 525 NE Oregon Street, Suite 500, Portland, Oregon 97232, (503) 230-5400. All correspondence should include the above referenced file number.

Sincerely,

for Kemper M. McMaster
State Supervisor

Attachments
SP 634
cc: OSO-ES
ODFW (nongame)
cc: Bureau of Reclamation
Pacific North West Region
cc: Leonard LeCaptain
Klamath Falls
cc: Scott Center FWS
Roseburg

ATTACHMENT A

FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CANDIDATE SPECIES AND SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE AREA OF THE ROGUE RIVER BASIN PROJECT AREA

1-7-00-SP-634

LISTED SPECIES[1/]

Birds		
Bald eagle	*Haliaeetus leucocephalus*	T
Northern spotted owl[2/]	*Strix occidentalis caurina*	CH T
Fish		
Coho salmon (S. Oregon/N. Calif. Coast)[3/]	*Oncorhynchus kisutch*	**T
Invertebrates		
Vernal pool fairy shrimp	*Branchinecta lynchi*	T
Plants		
Gentner mission-bells[4/]	*Fritillaria gentneri*	E

PROPOSED SPECIES

Plants		
Large-flowered wooly meadowfoam[5/]	*Limnanthes floccosa* ssp. *grandiflora*	PE
Cook's lomatium[5/]	*Lomatium cookii*	PE

CANDIDATE SPECIES

Fish		
Steelhead (Klamath Mountains Province)[6/]	*Oncorhynchus mykiss*	**CF
Amphibians and Reptiles		
Oregon spotted frog[7/]	*Rana pretiosa*	

SPECIES OF CONCERN

Mammals	
White-footed vole	*Arborimus albipes*
Pacific western big-eared bat	*Corynorhinus (=Plecotus) townsendii townsendii*
California wolverine	*Gulo gulo luteus*
Pacific fisher	*Martes pennanti pacifica*
Long-eared myotis (bat)	*Myotis evotis*
Fringed myotis (bat)	*Myotis thysanodes*
Long-legged myotis (bat)	*Myotis volans*
Yuma myotis (bat)	*Myotis yumanensis*
Birds	
Northern goshawk	*Accipiter gentilis*
Tricolored blackbird	*Agelaius tricolor*
Olive-sided flycatcher	*Contopus cooperi (=borealis)*
Little willow flycatcher	*Empidonax traillii brewsteri*

Western least bittern	*Ixobrychus exilis hesperis*
<u>Amphibians and Reptiles</u>	
Tailed frog	*Ascaphus truei*
Northwestern pond turtle	*Clemmys marmorata marmorata*
Siskiyou Mountains salamander	*Plethodon stormi*
Northern red-legged frog	*Rana aurora aurora*
Foothill yellow-legged frog	*Rana boylii*
Cascades frog	*Rana cascadae*
<u>Fish</u>	
Jenny Creek sucker	*Catostomus rimiculus* ssp.
Pacific lamprey	*Lampetra tridentata*
Southern OR/CA Coastal cutthroat trout	*Oncorhynchus clarki clarki*
<u>Invertebrates</u>	
Denning's agapetus caddisfly	*Agapetus denningi*
Franklin's bumblebee	*Bombus franklini*
Siskiyou chloealtis grasshopper	*Chloealtis aspasma*
Green Springs Mountain farulan caddisfly	*Farula davisi*
Sagehen Creek goeracean caddisfly	*Goeracea oregona*
Schuh's homoplectran caddisfly	*Homoplectra schuhi*
Siskiyou gazelle beetle	*Nebria gebleri siskiyouensis*
Mardon skipper butterfly	*Polites mardon*
Siskiyou caddisfly	*Tinodes siskiyou*
<u>Plants</u>	
Henderson's bentgrass	*Agrostis hendersonii*
Crenulate grape-fern	*Botrychium crenulatum*
Broad-leaf mariposa-lily	*Calochortus nitidus*
Greene's mariposa-lily	*Calochortus greenei*
Tall bugbane	*Cimicifuga elata*
Mount Mazama collomia	*Collomia mazama*
Clustered lady's-slipper	*Cypripedium fasciculatum*
Umpqua green-gentian	*Frasera umpquaensis*
Bellinger's meadowfoam	*Limnanthes floccosa* ssp. *bellingeriana*
Slender meadow-foam	*Limnanthes gracilis* ssp. *gracilis*
White meconella	*Meconella oregana*
Detling's microseris	*Microseris laciniata* ssp. *detlingii*
Pygmy monkeyflower	*Mimulus pygmaeus*
Coral seeded allocarya	*Plagiobothrys figuratus* ssp. *corallicarpus*
Southern Oregon buttercup	*Ranunculus austro-oreganus*
Columbia cress	*Rorippa columbiae*
Applegate stonecrop	*Sedum oblanceolatum*

(E) - Listed Endangered *(T) - Listed Threatened* *(CH) - Critical Habitat has been designated for this species*
(PE) - Proposed Endangered *(PT) - Proposed Threatened* *(PCH) - Critical Habitat has been proposed for this species*

Species of Concern - Taxa whose conservation status is of concern to the Service (many previously known as Category 2 candidates), but for which further information is still needed.

(CF) - Candidate: National Marine Fisheries Service designation for any species being considered by the Secretary for listing for endangered or threatened species, but not yet the subject of a proposed rule.

*** Consultation with National Marine Fisheries Service required.*

1/ *U. S. Department of Interior, Fish and Wildlife Service, December 31, 1999, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.*

2/ *Federal Register Vol. 57, No. 10, January 15, 1992, Final Rule-Critical Habitat for the Northern Spotted Owl*

3/ *Federal Register Vol. 62, No. 87, May 6, 1997, Final Rule-Coho salmon*

4/ *Federal Register Vol. 64, No. 237, December 10, 1999, Final Rule -Fritillaria gentneri*

5/ *Federal Register Vol. 65, No.94, May 25, 2000, Proposed Rule - Lomatium cookii and Limnanthes floccosa ssp. grandiflora*

6/ *Federal Register Vol. 63, No. 53, March 19, 1998, Final Rule-West Coast Steelhead*

7/ *Federal Register Vol. 62, No. 182, September 19, 1997, Notice of Review-Candidate or Proposed Animals and Plants*

ATTACHMENT B

FEDERAL AGENCIES RESPONSIBILITIES UNDER SECTION 7(a) and (c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a)-Consultation/Conference

Requires:

1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;
2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of Critical Habitat. The process is initiated by the Federal agency after they have determined if their action may affect (adversely or beneficially) a listed species; and
3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed Critical Habitat.

SECTION 7(c)-Biological Assessment for Major Construction Projects[1]

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify proposed and/or listed species which are/is likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, the accuracy of the species list should be informally verified with our Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct and on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or for potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within FWS, National Marine Fisheries Service, State conservation departments, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures and (6) prepare a report documenting the results, including a discussion of study methods used, nay problems encountered, and other relevant information. The BA should conclude whether or not a listed species will be affected. Upon completion, the report should be forwarded to our Portland Office.

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[1]A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332. (2)c). On projects other that construction, it is suggested that a biological evaluation similar to the biological assessment be undertaken to conserve species influenced by the Endangered Species Act.

— APPENDIX B—

Hydrology

Little Butte and Bear Creek Surface Water Distribution Model
DRAFT - Model Version March 26, 2003

by Leslie Stillwater
April 9, 2003

INTRODUCTION

This document describes the computer model[1] developed to simulate the surface waters, return flows, natural flow rights and storage accounting of Little Butte and Bear Creeks which are tributaries to the Rogue River.

Background

The model was developed for the Little Butte / Bear Creeks Management Project Steering Committee (formerly, IPOD) to demonstrate the effects of saved water and alternative and supplemental water supplies. The irrigation districts and other local irrigators, the State water master, and technical specialists from Federal and State natural resource agencies, provided direction and input for model development.

The model consists of a network representing the physical and operational characteristics of Little Butte and Bear Creeks. Simulations are performed by applying the historic monthly water supply from water years 1962 through 1999 to the model network.

The physical scope of the model covers the transbasin diversions from the Klamath Basin at Fourmile and Jenny Creeks; Fourmile, Fish Lake, Hyatt, Howard Prairie, Emigrant and Agate Reservoirs; diversions from Emigrant and Bear Creeks downstream to just past the Jackson Creek below Central Point; and diversions from North and South Fork Little Butte Creeks to just past their confluence. This coverage includes all of the Rogue River Basin Project (Talent Division) impacts to the Rogue River Basin.

Viewing Model Output

An enormous quantity of data is generated for each model run. To simplify analysis, selected model output can be viewed using the data access tool Pisces[2].

MODEL BASICS

Modeled Delivery Requests

In the model, irrigated lands request water based upon the following parameters:

- the number of acres irrigated,
- irrigation requirement (acre-feet/acre),
- water supply year type (dry, average or wet), and
- on-farm efficiencies.

Modeled Diversions

[1] Modsim , a general-purpose river and reservoir operations simulation model, was used. Modsim was developed at Colorado Statue University in the 1970's and since 1992 under joint agreement with the U.S. Bureau of Reclamation Pacific Northwest Region (PNRO).

[2] Pisces was developed by PNRO for viewing and formatting data from a variety of databases, including Modsim output, Hydromet and USGS archives. Pisces is currently available on CD or via email by request and can also be made available through the web.

Modeled requests for deliveries can be met by diversion into the major canals, taking into consideration the following parameters:

- distribution efficiencies (canal losses),
- natural flow rights in priority (if applicable), and
- project water in Emigrant, Hyatt and Howard Prairie Reservoirs (if water is available in the spaceholder's account) and stored water in Fish Lake and Fourmile Reservoir.

Delivery requests can also be met by return flows and runoff from neighboring lands, if available in the alternative.

Modeled Irrigation Shortages

The model determines irrigation shortage at each major canal. Irrigation shortage is the deficiency at the point of diversion, either from Bear Creek or from the Medford and Hopkins Canals.

MODEL PARAMETERS

Number of Acres Irrigated

The lands modeled are based on preliminary estimates of the Proof Survey and are listed in Table 1.

Lands, which are not listed in the table, but are currently either diverting flows or benefiting from return flows and runoff, are not explicitly modeled. The behavior and impacts of these lands are implicitly modeled in the gains and losses to each reach which are calculated from observed (historic) flows.

Irrigation Requirement

Irrigation Requirement is the crop evapotranspiration minus the effective precipitation. See table Bear Creek Basin-Irrigation Water Requirements.

Diversion Requirement

The modeled diversion requirement is the quantity of water needed at the point of the diversion to satisfy the irrigation requirement. The diversion requirement is determined by dividing the irrigation requirement by the on-farm and distribution efficiencies (discussed in the sections that follow). The diversion requirements are shown in Table 2. When diversion requirements can not be met by the model, shortages occur.

Water Supply Year Type

Water supply year type, as defined in the model, is an attempt to acknowledge that irrigators and reservoir operators make decisions based not only on forecasted inflows, but also on the current state of the reservoirs. Historic WY1962 through WY1999 monthly inflows to Emigrant, Howard Prairie and Hyatt Reservoir plus the observed end-of-month contents of the reservoirs were summed and sorted. An average water supply for each month was then defined as falling within the 40% to 60% exceedance range. Dry through wet water year types were determined accordingly.

Water supply year type affects delivery requests in the model.

Table 1. Modeled Number of Acres Irrigated			
Irrigation District	***Point of Diversion***	***Acres Irrigated***	***Comments***
Talent ID			
	Ashland Lateral	1940	1640 TID; 300 Ashland Ditch Co.
	East Lateral	10700	1810 eastside; 8890 westside
	Talent Lateral (Oak Street Diversion Dam)	4020	eastside
Medford ID[3]			
	Phoenix Canal and Medford Canal	6770	westside
	Medford Canal	4164	above siphon at Bear Crk
Rogue River Valley ID			
	Westside	3600	served by the Bear Crk Canal (Jackson Street Diversion Dam) and the Hopkins Canal
	Eastside	5280	served by the Hopkins Canal
	'1000 acres'	1000	above Agate Reservoir on the Hopkins Canal
	'40 acres'	40	served by the Medford Canal

Table 2. Modeled Diversion Requirements (acre-feet / acre)

District->	Rogue River Valley and Medford			Talent		
Year Type->	**Average**	**Wet**	**Dry**	**Average**	**Wet**	**Dry**
April	.37	.41	.32	.16	.19	.27
May	.57	.64	.50	.56	.54	.48
June	.78	.88	.69	.71	.66	.50
July	1.11	1.25	.98	.74	.87	.66
August	.91	1.02	.80	.69	.84	.62
September	.57	.64	.50	.45	.62	.31
October	.16	.18	.14	.01	.01	.06
sum	**4.47**	**5.02**	**3.93**	**3.32**	**3.73**	**2.90**

Distribution Efficiencies

[3] Preliminary Proof Survey values for irrigated lands on Medford ID were used. Final Proof Survey values may be greater but the increase would have only negligible impacts to study results.

Distribution efficiency is the water delivered divided by the water diverted at the main canal (either from Bear Creek or the Hopkins and Medford Canals). Current distribution efficiencies were determined from delivery and diversion data.

Current distribution efficiencies for Talent Irrigation District, without considering spills from the Ashland Lateral, are from 75% to 79%.

Ashland Lateral spills to Emigrant Reservoir at Cooke siphon are estimated as 42% of the diversion in May; 35% in June; 22% in July; 9% in August; and 11% in September.

Current distribution efficiencies for Medford and Rogue River Valley Irrigation Districts are estimated as 83%.

Distribution *in*efficiencies and losses are shown in Table 3. Sources for the data and calculations can be found in footnotes on the same page.

On-Farm Water Use Efficiencies

On-farm water use efficiency is defined as the irrigation requirement divided by the farm delivery. Estimated on-farm efficiencies for lands served by the Talent Lateral were calculated from the irrigation requirements (see Appendix A), the reported diversions, and estimated distribution efficiencies. Talent Lateral on-farm efficiencies range from 75% to 98%. Similar efficiencies were applied to all Talent Irrigation District lands. On-farm efficiencies for Talent lands, calculated in this manner, are likely high due to intercepted runoff. However, Talent diversions and lands are the uppermost in the system and the intercepted runoff did not originate as return flows and excess from neighboring lands. This means that Talent's diversion requests in the model appropriately reflect the availability of intercepted flows.

On-farm water use efficiencies for Medford and Rogue River Valley Irrigation Districts are assumed to be about 66% under current conditions. This value does not include intercepted return flows, and allows for the investigation of the effects of the loss of intercepted return flows in alternatives which tighten irrigation and delivery efficiencies upstream.

Losses from the Howard Prairie Delivery Canal

Modeled losses from the Howard Prairie Delivery Canal are based on WY2002 measured flows. Estimated losses are 8% in October; 5% in May; 8% in June; and 12% in July. In November through February, the canal gains flow and in March through April losses are less than 3%. The losses also reflect intercepted local flows.

Natural Flow Rights

In the model, natural flow can be diverted in priority to meet delivery requests. Natural flow is measured at the point of diversion in the major canals, so if distribution loss occurs in the canal, a portion of the natural flow delivery is lost but still contributes to the flow delivery rate calculation.

Storage rights are used to fill reservoirs. These storage rights compete in priority with natural flow rights for diversion.

Table 4 shows the natural flow rights modeled.

Table 3. Modeled Distribution Losses		
Location	***Spill or Loss***	***Comments***
Ashland Lateral - from point of diversion to Cooke Siphon	9% to 42% of diversion	spilled back into Emigrant Reservoir; percentages vary by time of year; based on 1994-2001 measured flows
Ashland Lateral - from Cooke Siphon to Farm	20-25% of remaining diversion (after spill at Cooke Siphon)	estimated[4].
East Lateral	20-25% of diversion	estimated[5]
Talent Lateral	20-25% of diversion	estimated
Phoenix	17% of diversion	estimated[6]
Bear Crk Canal (Jackson Street Diversion)	17% of diversion	estimated[7]
Joint System Canal above Bradshaw Drop	about 25% of diversion	based on observed loss between gaging stations; may be due to undocumented irrigation; not recovered.
Hopkins Canal	25.5% of flow diverted into the Hopkins Canal at Bradshaw Drop	estimated[8]; not recovered
Medford Canal	17% of flow diverted into the Medford Canal at Bradshaw Drop	estimated
Howard Prairie Delivery Canal below Howard Prairie	8-12%	varies by month, based on WY2001 measured flows; not recovered
Cascade Canal	33%	based on observed loss between gaging stations; not recovered

Reservoir Storage and Accounting

[4] A comparison of values in: the Talent Irrigation District Water Management/Conservation Plan (Conservation Plan), Talent Irrigation District and H&R Engineering, October, 1998 and The Bear Creek/Little Butte Creek Water Management Study Appraisal Report and Appendix, U.S. Bureau of Reclamation, February 2001 (Appraisal Report).

[5] estimated delivery efficiency values for the major canals are reported in TID's Water Conservation Plan.

[6] Medford Irrigation District Water Conservation Plan, 1995.

[7] Rogue River Valley Irrigation District Water Management/Conservation Plan, Rogue River Valley Irrigation District and H&R Engineering, October, 1998.

[8] Appraisal Report.

After delivery requests have exhausted their available natural flow in priority and private stored water in Fourmile Reservoir and Fish Lake, they rely on the delivery of project stored water, if water is available in their storage account. Stored water is measured at the point of diversion, so just like natural flow, if distribution loss occurs, that loss is charged to the user's storage account.

When water is diverted, it is debited from the user's storage account. Carryover from year to year is allowed, but users may have to share in operational losses and evaporation. Users also benefit if a reservoir is allowed to backfill.

Table 5 shows the storage accounts maintained in the model.

Other Parameters

Limitations on trans-basin diversions. In the model, flow through the Cascade Canal, and the Deadwood and Dead Indian diversions is limited to the historic observed flows. This means that the model is not managing those diversions. This approach is appropriate because many factors which can not be modeled, including accessibility, determine the rate and timing of diverted flows.

Table 4. Modeled Natural Flow Rights

	Priority Date	*Rate/ Capacity*	*Owner*	*Allowed diversion dates*	*Comments*
Little Butte Creek					
North Fork	1909	125 cfs	MID, RRVID	1Apr - 31Oct	
South Fork	1909	100 cfs	MID, RRVID	1Apr - 31Oct	
Bradshaw Drop		140 cfs	MID, RRVID		source: Osborn Crk and others; not modeled due to lack of adequate water supply data
Little Butte Creek below confluence	~1800	24 cfs	others	1Apr - 31Oct	satisfies all the senior water rights on Little Butte Creek; MID and RRVID 'exchange' storage water for this flow
Bear Creek					
	1Mar 1915	60 cfs	MID		Phoenix capacity = 60 cfs
	24Jun 1913	40 cfs	RRVID		Jackson St Diversion capacity = 40 cfs
	31Jul 1915	28 cfs	TID		Ashland Crk; Neil Crk
	~1860 - 1888	un-known			not explicitly modeled; no data are available to determine current diversion rates; likely satisfied by return flows; implicitly described in the modeled water supply, but in alternatives with no return flows these rights may not be adequately modeled
Storage Rights					
Fish Lake	1910			15Oct - 1Apr+	allowed to backfill
Emigrant	6Sep 1915	36658 AF	USBR		This includes Hyatt stored water as well as natural flow.
Emigrant	27Jan 1920	40 cfs; 2342 AF	TID		Modeled as additional capacity to the 6Sep1915 USBR right to fill Emigrant because it is included in the 7.39% preferred capacity in the contract
Fourmile	31Mar 1910	15800 AF	MID, RRVID		
Howard Prairie	6Sep 1915	60600 AF	USBR	1Nov- 31May	
South Fork Little Butte Creek	23May 1912	60 cfs	TID	year round	contributes to Howard Prairie
Hyatt	31Jul 1915	16200 AF, 136 cfs	TID	1Nov- 31May	Keene Crk water right; 100 cfs of the 136 is also Green Spring Power Plant's right; that 100 cfs is natural flow for Ashland Lateral, but is allowed to be stored and delivered at a later date

Table 5. Modeled Storage Accounts

	share	capacity (acre-feet)	Comments
Howard Prairie, Hyatt and Emigrant combined		**115,800**	
Talent ID preferred	7.3913 %	8,559	provided ‘first fill’
Medford ID	7.5117 %	8,698	
Rogue River Valley ID	3.7559 %	4,349	
Talent ID	81.3411 %	94,193	
Fish Lake and Fourmile combined		**23,450**	
Medford ID	66 %	15,633	
Rogue River Valley ID	33 %	7,817	
Agate Reservoir		4,700	
Rogue River Valley ID	100%	4,700	filled by Dry Creek; also re-regulates Fourmile and Fish Lake flows

CALIBRATION AND PROPOSED ACTION ALTERNATIVES

Calibration

The model has been calibrated to the available data for observed streamflows, diversions, and reservoir contents. Where data were not available, an attempt was made to estimate the data through correlations with other sources. Model calibration can be checked by comparing historic observed flows and reservoir contents with the Proposed Action flows and contents (Pisces can be used for this check).

Proposed Action Alternative

The Proposed Action Alternative represents the current physical and operational parameters of the Little Butte Creek / Bear Creek system. Modeled Proposed Action reservoir contents, streamflows, diversions and shortages may differ from historic and present day system states because:

- Land use has changed over the past 40 years and changes year to year depending on the perceived water supply. In the model, the number of acres requesting water does not change from year to year (see Tables 1 and 2 above.).

- Although the model enforces a strict interpretation of priority on water rights, that standard can never be practiced in the field. In practice, reservoirs may fill beyond their right when inflows are available, and the distinction between natural flow and stored water is less precise. Water may be diverted in the field beyond or without a right, when there is limited reporting on system inflows.

- The model reflects Reclamation's interpretation of project contracts.

- Inflows, diversions, losses and gains occur which are not or can not be quantified. If a process is not quantified, it is handled in the model implicitly and may not be apparent to the modeler or the client. The assumption that these implicit processes will not impact or are not impacted by the modeled alternatives may not be true in the field.

- Parameters in Tables 1 through 5 apply.

Bear Creek Basin - Irrigation Water Requirements

Crop Evapotranspiration - ET, (Ave year - 5 of 10 year) - Medford Area 1

Talent Irrigation District	Acres	% of area	April	May	June	July	Aug	Sept	Oct	Total
Crop										
Fruit - Apples,Pears,Cherries	4330.0	26.55	3.37	5.38	7.11	8.84	7.34	5.15	2.47	39.66
Alfalfa Hay	400.0	2.45	3.35	4.69	5.63	6.85	5.75	4.21	2.80	33.28
Grass Pasture	7080.0	43.41	3.58	5.04	6.02	7.32	6.06	4.45	2.83	35.30
Other hay - grass/alfalfa	4350.0	26.67	3.46	4.86	5.82	7.08	5.90	4.35	2.80	34.27
Misc	150.0	0.92	2.42	4.25	5.75	7.65	5.55	3.3	1.6	30.52
Total acres	16310.0	100.00								
Total weighted ET - ac-in/ac			3.48	5.07	6.24	7.65	6.34	4.59	2.71	36.08
Total weighted ET - ac-ft/ac			0.29	0.42	0.52	0.64	0.53	0.38	0.23	3.01
Total AF			4730	6891	8481	10398	8617	6239	3683	49039

Medford Irrigation District	Acres	% of area	April	May	June	July	Aug	Sept	Oct	Total
Crop										
Fruit - Apples,Pears,Cherries	1274.0	10.18	3.37	5.38	7.11	8.84	7.34	5.15	2.47	39.66
Alfalfa Hay	570.0	4.55	3.35	4.69	5.63	6.85	5.75	4.21	2.80	33.28
Grains	240.0	1.92	2.66	5.44	6.83	6.28	0.50	0.00	0.00	21.71
Vegetables/turf/etc.	637.0	5.09	3.20	3.75	5.25	7.60	6.20	4.60	2.00	32.60
Grass Pasture	9144.0	73.04	3.58	5.04	6.02	7.32	6.06	4.45	2.83	35.30
Seed	451.0	3.60	1.90	3.00	4.70	7.40	6.90	5.00	3.00	31.90
Misc	203.0	1.62	2.42	4.25	5.75	7.65	5.55	3.3	1.6	30.52
Total acres	12519.0	100.00								
Total weighted ET - ac-in/ac			3.43	4.92	6.04	7.45	6.10	4.43	2.68	35.05
Total weighted ET - ac-ft/ac			0.29	0.41	0.50	0.62	0.51	0.37	0.22	2.92
Total AF			3580	5127	6300	7778	6362	4625	2798	36570

Rogue River Valley Irrigation District	Acres	% of area	April	May	June	July	Aug	Sept	Oct	Total
Crop										

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Fruit - Apples,Pears,Cherries	882.0	10.18	3.37	5.38	7.11	8.84	7.34	5.15	2.47	39.66
Alfalfa Hay	394.0	4.55	3.35	4.69	5.63	6.85	5.75	4.21	2.80	33.28
Grains	166.0	1.92	2.66	5.44	6.83	6.28	0.50	0.00	0.00	21.71
Vegetables/turf/etc.	440.0	5.08	3.20	3.75	5.25	7.60	6.20	4.60	2.00	32.60
Grass Pasture	6327.0	73.04	3.58	5.04	6.02	7.32	6.06	4.45	2.83	35.30
Seed	312.0	3.60	1.90	3.00	4.70	7.40	6.90	5.00	3.00	31.90
Misc	141.0	1.63	2.42	4.25	5.75	7.65	5.55	3.3	1.6	30.52
Total Acres	8662.0	100.00								
Total weighted ET - ac-in/ac			3.43	4.91	6.04	7.46	6.10	4.43	2.68	35.05
Total weighted ET - ac-ft/ac			0.29	0.41	0.50	0.62	0.51	0.37	0.22	2.92
Total AF			2477	3547	4358	5382	4402	3200	1935	25301

1/ From: Oregon Crop Water Use & Irrigation Requirements, OSU Extension Misc 8530, March 1999

Crop Irrigation Requirement - IR, (Ave year - 5 of 10 year) - Medford Area 1

Talent Irrigation District			April	May	June	July	Aug	Sept	Oct	Total
	Acres	% of area								
Crop										
Fruit - Apples,Pears,Cherries	4330.0	26.55	2.12	4.10	6.20	8.65	7.20	4.38	0.95	33.60
Alfalfa Hay	400.0	2.45	2.05	3.50	4.84	6.73	5.59	3.46	0.00	26.17
Grass Pasture	7080.0	43.41	2.58	3.78	5.16	7.20	5.91	3.74	1.22	29.59
Other hay - grass/alfalfa	4350.0	26.67	2.30	3.60	5.00	6.95	5.75	3.60	1.22	28.42
Misc	149.0	0.91	2.00	4.50	5.40	6.60	5.20	3.80	1.40	28.90
Total acres	16309.0	100.00								
Total weighted IR - ac-in/ac			2.35	3.80	5.37	7.52	6.19	3.86	1.02	30.11
Total weighted IR - ac-ft/ac			0.20	0.32	0.45	0.63	0.52	0.32	0.08	2.52
Total AF			3262	5219	7304	10204	8415	5243	1384	41031

Medford Irrigation District			April	May	June	July	Aug	Sept	Oct	Total
	Acres	% of area								
Crop										
Fruit - Apples,Pears,Cherries	1274.0	10.18	2.12	4.10	6.20	8.65	7.20	4.38	0.95	33.60
Alfalfa Hay	570.0	4.55	2.05	3.50	4.84	6.73	5.59	3.46	0.00	26.17
Grains	240.0	1.92	1.70	4.08	5.04	6.50	0.65	0.00	0.00	17.97

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July 5, 2002

Vegetables/turf/etc.	637.0	5.09	2.00	3.00	3.00	7.99	6.81	4.09	0.47	27.36
Grass Pasture	9144.0	73.04	2.58	3.78	5.16	7.20	5.91	3.74	1.22	29.59
Seed	451.0	3.60	0.75	1.85	4.10	7.20	6.70	4.30	1.50	26.40
Misc	203.0	1.62	2.00	4.50	5.40	6.60	5.20	3.80	1.40	28.90
Total acres	12519.0	100.00								
Total weighted IR - ac-in/ac			2.39	3.71	5.10	7.34	6.00	3.76	1.09	29.39
Total weighted IR - ac-ft/ac			0.20	0.31	0.43	0.61	0.50	0.31	0.09	2.45
Total AF			2494	3868	5325	7660	6248	3922	1135	30652
Rogue River Valley Irrigation District			April	May	June	July	Aug	Sept	Oct	Total
	Acres	% of area								
Crop										
Fruit - Apples,Pears,Cherries	882.0	10.18	2.12	4.10	6.20	8.65	7.20	4.38	0.95	33.60
Alfalfa Hay	394.0	4.55	2.05	3.50	4.84	6.73	5.59	3.46	0.00	26.17
Grains	166.0	1.92	1.70	4.08	5.04	6.50	0.65	0.00	0.00	17.97
Vegetables/turf/etc.	440.0	5.08	2.00	3.00	3.00	7.99	6.81	4.09	0.47	27.36
Grass Pasture	6327.0	73.04	2.58	3.78	5.16	7.20	5.91	3.74	1.22	29.59
Seed	312.0	3.60	0.75	1.85	4.10	7.20	6.70	4.30	1.50	26.40
Misc	141.0	1.63	2.00	4.50	5.40	6.60	5.20	3.80	1.40	28.90
Total Acres	8662.0	100.00								
Total weighted IR- ac-in/ac			2.39	3.71	5.10	7.34	6.00	3.76	1.09	29.39
Total weighted IR - ac-ft/ac			0.20	0.31	0.43	0.61	0.50	0.31	0.09	2.45
Total AF			1723	2677	3685	5300	4322	2714	786	21207
1/ From: "Oregon Crop Water Use & Irrigation Requirements", OSU Extension Misc 8530, March 199										
SUMMARY - ET, IR & Effective Precip										
			April	May	June	July	Aug	Sept	Oct	Total
Talent ID - 16309 acres										
Total weighted ET - ac-in/ac			3.48	5.07	6.24	7.65	6.34	4.59	2.71	36.08
Total weighted IR - ac-in/ac			2.35	3.80	5.37	7.52	6.19	3.86	1.02	30.11
Effective Precip (ET minus IR)			1.13	1.27	0.87	0.13	0.15	0.73	1.69	5.97
Medford ID - 12519 acres										
Total weighted ET - ac-in/ac			3.43	4.92	6.04	7.45	6.10	4.43	2.68	35.05
Total weighted IR - ac-in/ac			2.39	3.71	5.10	7.34	6.00	3.76	1.09	29.39

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HandR Engineering
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Effective Precip (ET minus IR)		1.04	1.21	0.94	0.11	0.10	0.67	1.59	5.66
RRVID - 8662 acres									
Total weighted ET - ac-in/ac		3.43	4.91	6.04	7.46	6.10	4.43	2.68	35.05
Total weighted IR- ac-in/ac		2.39	3.71	5.10	7.34	6.00	3.76	1.09	29.39
Effective Precip (ET minus IR)		1.04	1.20	0.94	0.12	0.10	0.67	1.59	5.66
COMPARE Effective Precip and Average Precip									
Weighted Effective Precip (37490 acres)		1.08	1.23	0.91	0.12	0.12	0.70	1.63	5.79
(represents ET minus IR)									
Ave Precip (OSU/Medford Exp. Sta. - 1948-1989)		1.18	1.28	0.92	0.29	0.43	0.88	1.90	6.88
Ave Precip (OSU/Medford Exp. Sta. - 1980-2001)		1.69	1.38	0.87	0.36	0.47	0.68	1.45	6.90

NOTES

ET represents crop evapotranspiration. IR represents crop irrigation requirement. IR does not include seasonal on-farm irrigation application efficiency.

Rather than recalulate crop ET and IR using short term weather data, or use the short term research data from BOR study (i.e. Jerry Buchheim), published data was used (i.e. OSU Misc 8530). It was felt this source of data could be well supported as being long term data. Values displayed here may be different than that displayed in the Water Management / Conservation Plans. Data used in those Plans came from the BOR study. It is felt that data represents a rather short period of years. Data used in this analysis represents long term weather data, i.e. 30 years or more. IR values presented here does not include any credit for winter soil moisture carryover into the start of the growing season.

Year by year ET & IR values are generally growing season climate related and not related to high or low water supply years. For example, a low water supply year does not mean a low IR and a high water supply year does not mean a high IR, or visa versa. However, a low water supply year can be a low IR year if delivery is reduced during the season or cutoff to the user during the growing. season. And however, a high water supply year generally is not a high IR year, unless the average year delivery represents a deficit delivery situation, and a high water supply year then represents higher on-farm delivery resulting in higher crop yields.

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